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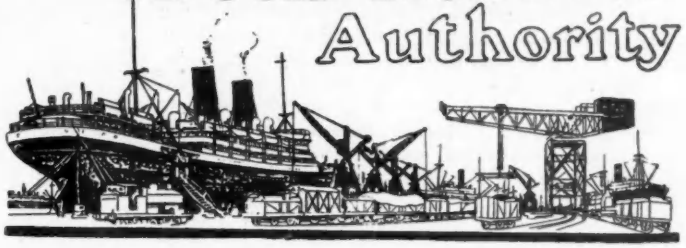
The Dock & Harbour Authority



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Editorial Comments

The Port of Cochin.

The Port of Cochin, which is situated on the Malabar Coast of India, 580 miles south of Bombay, is among the large natural harbours in the world, but owing to the obstruction caused by an extensive bar of sand and mud that blocked the opening, it was not developed as a port for commercial purposes until the present century.

Cochin is the oldest European settlement in India, the first Christian church in India was built here, and it was here that Vasco-de-Gama died. The first important historical reference to the area was early in the sixteenth century, when Captain-General Cabral, in command of a fleet of Portuguese vessels, sailed over the bar at the entrance to the harbour, and made a treaty with the Rajah to establish a trading settlement. The Portuguese were succeeded by the Dutch in 1663, who in turn, gave way to the British in 1795.

Until recent years, there was only a roadstead at Cochin, and vessels were compelled to anchor about three miles off the coast, their cargoes being conveyed ashore by means of sea-going lighters. The leading article for this issue, from the pen of Sir R. Bristow, who, from 1920 to 1942 was the Chief Engineer and General Manager of the port, gives an interesting account of the cutting of a navigable channel through the outer bar and the development of the harbour into one of the major ports of India.

Ice Blockade of Ports.

A matter of very serious importance to certain ports, such as Montreal, Quebec, Archangel and a number of others situated in localities where, during considerable periods of the year, the temperature falls and remains appreciably below freezing point, is the interruption of their seaborne traffic through the formation of ice in their harbour waters and approach channels. In the case of the River St. Lawrence, navigation is necessarily suspended from the end of November or the beginning of December till the late Spring and all cargo shipments during the months in question from the provinces of Ontario and Quebec have to be diverted to the ports of St. John, Halifax and other ports on the Atlantic Coast. Such a disability is a serious interference with normal port operation and a detraction from the serviceability of the ports in question. Much has been done by the use of ice-breakers to keep the navigable channel open as long as possible, but in proportion as the frost conditions become more intense, there is a limit to their effective action. In fact, during the height of the winter season the harbour of Montreal is completely blocked by masses of ice which, at times, tower over the quay copings and invade their margins to the detriment of adjacent structures. For this reason the level of the quays is made abnormally high compared with the water level in the basins.

The present issue of this Journal contains a Paper by Mr. J. G. G. Kerry, a Canadian engineer, who has given some time and attention to the subject and has summarised the extent of the information available on the conditions of ice formation on the rivers and lakes of the northern regions of the United States and Canada, as well as in Europe. He has found that there is scope and need for the acquisition of further data to enable the problem to be investigated with greater precision and thoroughness and has put forward a plea for Government assistance in the matter, the field of enquiry being too extensive for individual enterprise. The plea commands our sympathy, as it must also that of all port authorities, shipping and commercial agencies and others who are concerned with the continuous maintenance of port accessibility throughout the year in regions which are infested with ice. It is to be hoped that there will be adequate official response to Mr. Kerry's appeal, since, though it is not quite clear what further measures can be devised to counteract the evil, the first step, obviously, is to ascertain all the relevant facts which can be obtained from observation and experience.

The Dock and Harbour Authorities' Association and Port Administration.

On the last day but one of February and just before the closing of the present issue for press, the Annual General Meeting of the Dock and Harbour Authorities' Association was held in London and was noteworthy for the discussion of two subjects of great importance to the members. An account of the proceedings is set set out on a later page, from which our readers will see that the two subjects were the Transport Bill and War Damage Claims, both of which were touched upon by the retiring President, Sir Frederick West, in his address from the chair.

The former topic was undoubtedly the more important. It is clearly evident that there is wide divergency between the views of the Association and those of the Government in regard to the future administration of ports in this country, although, as yet, as pointed out by the President, the intentions of the Government are far from being clearly defined. In fact, it is the very vagueness and uncertainty on matters of vital import which causes such grave concern. Yet, from the fragmentary and disjointed admissions of Ministers in Parliament it is possible to trace the trend of their policy.

The Association are desirous of retaining the present local autonomous control which obtains in the great majority of cases, and which has worked quite satisfactorily. In their submission to the Government they have simply recommended the establishment of an Advisory Council to assist the Minister of Transport on questions which may arise requiring higher decision. Mr. Strauss, however, Parliamentary Secretary to the Ministry, as representing

Editorial Comments—continued

the Government, will have none of this. He has stated that " the unification of dock activities is essential " and that " the nation's port facilities must be regarded as one and not a series of competing units." This implies, so far as we can see, that local wishes and initiative are liable to be over-ruled and arbitrarily set aside under centralised direction. Healthy rivalry and competition between ports is to be eliminated and all of them are to be reduced to a dead level of stagnant uniformity under a main executive which will decide what is desirable in accommodation and equipment for each particular locality and define the scope of its activities. If to this be added, as is to be gathered from party pronouncements, the assignment of shipping movement to definite routes, it is quite possible that overseas trade will become a stereotyped process of signing on the dotted line without choice or variation. Freedom of trading will, in fact, be stifled and may be at the mercy of political considerations, such as has been exemplified in the recent outcry for the diversion of shipping tonnage to ports with which it is not normally associated. Initiative and enterprise will be at a discount.

The other matter to which we have alluded and regarding which there is an equally vague and uncertain government policy, viz., the settlement of War Damage claims, is still the subject of discussion and we will refer readers to the Report of the Executive Committee of the Association for a statement of the present position. It does not call for special comment.

The Association is to be congratulated on a year of energetic and successful work and the tribute paid to Colonel Beazley and the Executive Committee at the meeting was well deserved.

The Chamber of Shipping and the Transport Bill.

The practically simultaneous annual meeting of the Chamber of Shipping afforded its members an appropriate opportunity for expressing their views on the sections of the Transport Bill relating to docks and harbours, as well as on other matters affecting shipping generally. The Chamber has already shown an antipathy to the Bill and it has now followed up its earlier representations by a Resolution containing, *inter alia*, the statement that it

" deprecates the introduction of the principle of State ownership and centralised control into port administration and is of opinion that the efficiency of the ports depends upon maintaining in their responsible management local autonomy with adequate representation of those using the ports and providing the essential facilities "; and

" emphasises the dangers to efficiency involved in any attempt to put the operation of the many and differing ancillary services within the port under central control or, in general, under a single authority in the ports."

It was pointed out at the meeting that the reliance by the Minister of Transport on certain reflections on the then available port facilities by a Committee of the Chamber which reported as far back as 1923, is misplaced since their findings are no longer applicable. A later report in 1929 asserted that British Port Authorities have consistently pursued a progressive policy in regard to the maintenance and improvement of their ports. Indeed, a report by the Labour Party itself in 1944 admitted that " broadly speaking, dock facilities and methods in this country have a high efficiency." This completely invalidates the Government argument.

The foregoing expressions of expert opinion entirely endorse the view which has been taken by this Journal. It sees no advantage to be derived from interference with the prevailing principle of port administration by local autonomous bodies. On the contrary, it feels that very definite injury would be done to seaborne trade by any such interference.

Forth Pilotage Report.

In this issue we publish extracts from the Report by Sir Robert Letch on " Pilotage Arrangements in the Firth and River of Forth and at the ports situated in that Area." The Report was issued at the end of October last, but only became available for press notice towards the end of the year and shortage of space has compelled delay in its appearance in this Journal. It is, undoubtedly, a most comprehensive and masterly report, which should be studied carefully by all who are interested in the subject.

Pilotage is a necessary feature of port operation, the approaches to many ports being through intricate and even hazardous channels, requiring special knowledge of the shifting shoals and sandbanks in estuary areas. Such knowledge can only be acquired by local study and extensive experience. Hence, while not a universal requirement, pilotage (i.e., control of a vessel by a fully qualified pilot) is often compulsory.

The leading pilotage authority in this country is Trinity House, London, but a number of port authorities have their own pilotage committees; alternatively, there may be local associations to manage pilotage affairs. These diverse bodies have varying jurisdictions, rules and regulations, sometimes inconsistent with one another and even overlapping. Thus, in the area of the Firth of Forth, there are six independent pilotage authorities for the seven major ports located therein. As these ports and their approaches are all in close contiguity, it is eminently desirable that there should be some uniformity of administration, and Trinity House, Leith, has made representations to that effect to the Minister of Transport, who, in consequence, instructed Sir Robert Letch to enquire into the matter and report.

Sir Robert has produced an exhaustive statement with a recommendation for the establishment of a single centralised authority, which is too lengthy for detailed discussion here. We will content ourselves with allusion to one controversial point already mentioned above, viz.: compulsory or non-compulsory pilotage.

Non-compulsory pilotage has hitherto been the normal practice in the Forth Area and Sir Robert, in the face of strong opposition from the pilots themselves, has recommended its continuance. Certainly, during the wars of 1914-18 and 1939-45, pilotage was temporarily made compulsory under Admiralty orders, but this was due to war-time conditions and the existence of dangerous minefields. With the removal of the latter, the difficulties of navigation have been rendered negligible, so that a shipmaster, familiar with the locality, is quite competent to manœuvre his ship in and out of port with reasonable safety.

The question was gone into by the Commissioners of Pilotage in 1914 and by the Board of Trade in 1921. On neither of these occasions was it found desirable that there should be any change in the normal practice, and now that aids to navigation have become so numerous and effective, there is less ground than before for a reversal of the decision. It would seem that the opposition of the pilots is based on their financial interests and this, in our view, is hardly sufficient justification for the adoption of compulsory pilotage, notwithstanding that it is the rule at leading ports such as London, Liverpool, Glasgow and Belfast. It is largely a question of the physical character of the estuary and where this does not present any particular difficulty to navigation, compulsion to engage the services of a pilot should not be enforced.

Canada and the Free Port System.

Following the decision of the British Government that a free port system in Great Britain offers no advantage over the existing customs facilities (reference to which was made in this Journal in December last), it is interesting to observe that it has been announced at Ottawa that the inter-departmental committee which was set up to examine the possibilities of establishing a free port system in Canada has found that " it is at present inadvisable to pass enabling legislation for the creation of foreign trade zones in Canada."

The committee based its findings on unsettled world conditions, possible tariff changes in the near future, absence of convincing evidence that free ports would attract additional transhipment traffic, difficulties of administration because of Canada's tariff structure, and the ease with which shipments can now be handled under Canada's present bonding and manifesting regulations.

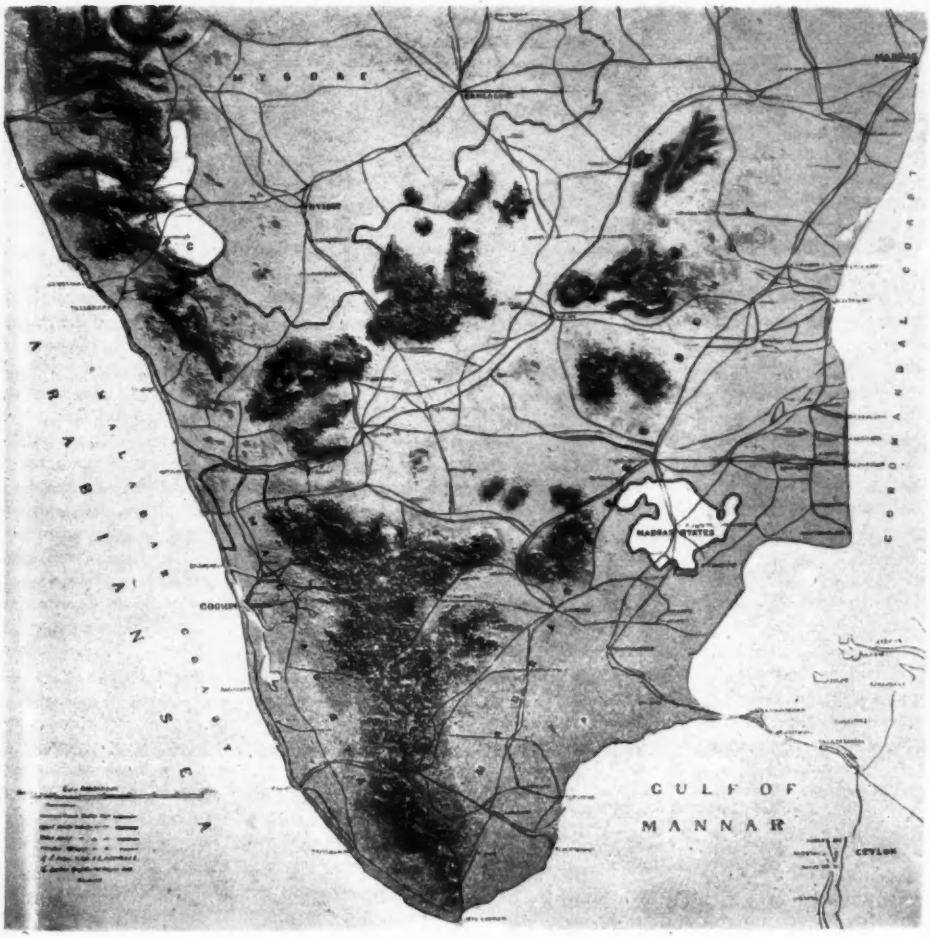
Foreign trade zones, the Committee stated, have only been created in countries not possessing bonding and manifesting regulations of the Canadian and British type.

The Port of Cochin, South India

An Account of the Development of a Natural Harbour

By SIR ROBERT BRISTOW, C.I.E., M.I.C.E., M.I.M.E.

I HAVE just read in the Journal of the Royal United Service Institution for August, 1945, the wonderful and exhilarating story of "The Prefabricated Harbour" (Mulberry), by Rear-Admiral Hickling, C.B.E., D.S.O., a miracle of conception, design and execution comparable only with the miracles of Dunkirk and the Battle of Britain. And my mind turned to our long-drawn-out struggle at Cochin where a magnificent harbour already in being only needed deepening and opening out to the sea, and equipping with the landing facilities of a modern port, to make it of equal utility. In the one case, seven months of supreme effort, regardless of cost; in the other, 21 years of constant pressure against constructional, administrative, legal, political and commercial difficulties, and yet at a cost microscopic in the scale of the first. This aspect of Cochin has already been recorded in the October, 1946, number of the *Asiatic Review*. In what follows I shall try to give in the space available a more technical narrative, not indeed lit up with the verve and sparkle of Admiral Hickling's lecture, but reflecting more of the quiet and prolonged study which preceded every stage of the operations and brought us at last to a triumphant conclusion, for with the fall of Singapore. "Cochin became a bastion of Empire."



Wooden Model of South India showing Railways, Roads, etc., and Hinterland served by the Port of Cochin

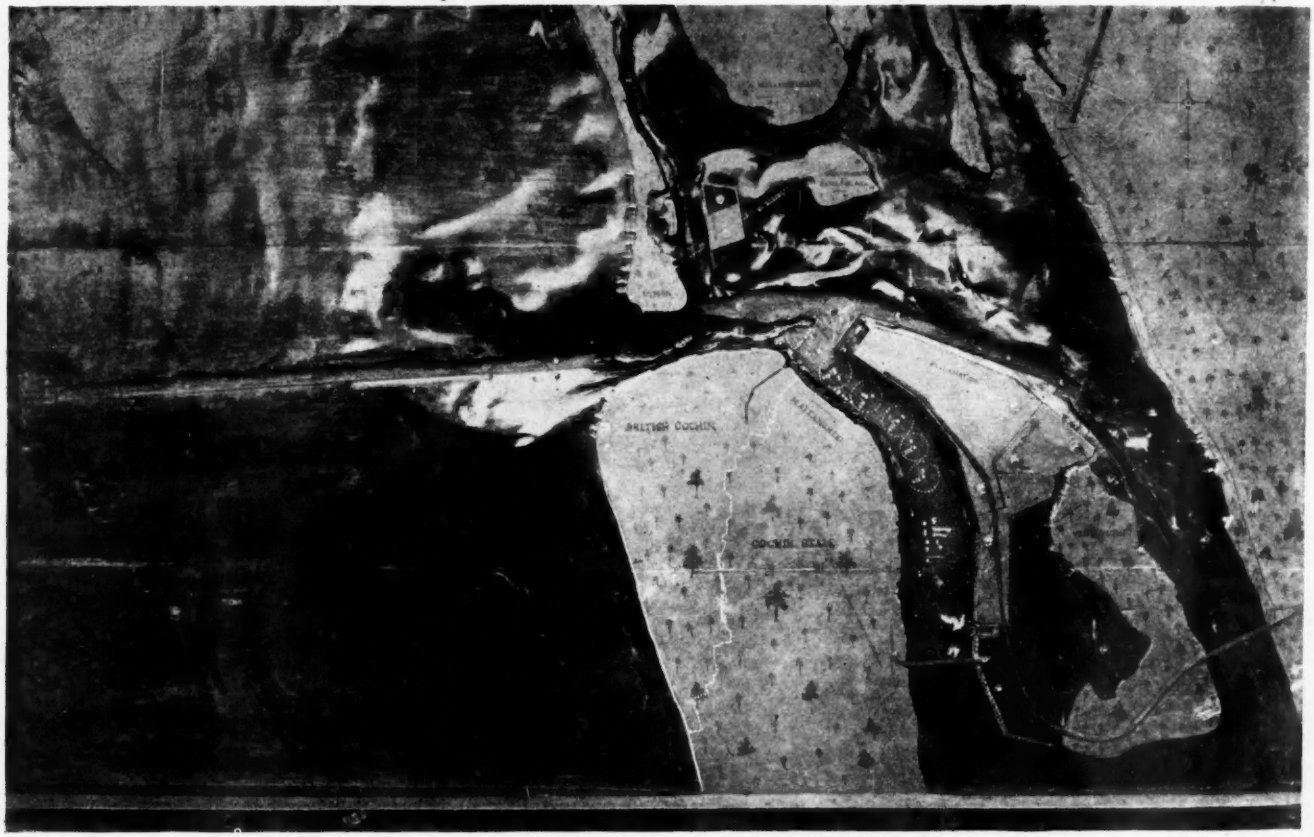
Those who know Portsmouth Harbour can easily picture Cochin. As you enter the narrow opening at Portsmouth the Haslar Peninsula on the left fits in with Vaipin, and Southsea front becomes British Cochin. Higher reaches left and right suggest similar but much longer reaches in Cochin Harbour and backwaters, and the Portsmouth Hills will do to represent Ernakulam on the mainland of India. Now imagine the backwaters of Cochin reaching far past Langstone and Chichester to Kent on the one side and to The Needles on the other, and some conception of the scale of Cochin appears, though the hills are much farther back from the Ernakulam foreshore than they are from Portsmouth. It is an immense sheet of water, tidal, rising 3-ft. at ordinary springs near the mouth and 8-in. at a point 40 miles south. The soil is all alluvium and the shores rise but a few feet above high water mark. Palm trees stretch interminably into the farthest view, and in the cocoanut groves so bountifully provided rural South India lives as it has lived for unknown centuries, peacefully, industriously and contentedly, except for periods in which the virus of recent alien ideologies disturbs its immemorial placidity. Fish, bananas, rice, curry; the products of the cocoanut tree; shallow pools of water; coir rope and matting; palm leaf and bamboo; the narrow inland canals; and the little canoes and larger "wallums"; of such is life made in these simple habitations.

Some 18 miles along the shorter navigable backwater lies the ancient Port of Muziris near the mouth of the Periyar River and now called Cranganur. With the discovery of the direct route to India from Egypt and the Persian Gulf in the first half of the first century A.D., due to the unravelling of the secret of the monsoon winds, Muziris became a famous trading centre. How long the Indians, and probably the Arabians, had known the secret is a matter for speculation; certain it is that the route was not new, and that the dreaded pirates of Nitrias, an island nearby, caused many ships to avoid Muziris and journey south to Bacare which became Porkad and is now merged into the roadstead of Alleppey, about 40 miles south of Cochin by backwater. At that time Cochin was unknown as a harbour and all that can be said with any confidence is that the backwater system was under the experimental workings of natural forces and seeking a final and permanent opening somewhere in the region of the present outlet. There, in times of flood, the lagoon opened to the sea and presently closed itself so that it became known to navigators and Greek historians as the "river with the false mouth" (Pseudostomos). Local tradition places the established breakthrough 13 centuries later and there is positive evidence that it was used in 1438. Quite probably the Chinese were the first to find it: they had been trading with Taprobane, now Ceylon, since the pre-Christian era.

Geologically, therefore, the surface formation is very modern,

Port of Cochin, South India—continued

and indeed our first problem at Cochin lay in this same fact. We had nothing really stable to guide our thoughts and investigations; even the dense sand of the bar that encompassed the opening moved west and east according to the relative strength of monsoon freshets and ocean swells. Alternate periods of erosion and accretion succeeded each other on the beaches north and south, sometimes rapidly and sometimes at long intervals; the influence of the travelling, and sometimes stationary, "Mudbanks of Malabar" was certain, but obscure. The tides could never be systematized owing to the alluvial floods which ran strongly to sea with the salt water forcing its way under at the rising springs; and strange movements of the sea bed both inside and outside the harbour completed our "problem of the variables." But we knew a good deal, too: that, over long periods, changes righted themselves; that the average rainfall was 120-in., 80-in. of which fell in the S.W. Monsoon, June-September; that the currents were rarely excessive, and cyclones almost unknown; that there was no rock to dredge; that labour and materials were abundant and cheap (how long ago it seems!) and that there was enough trade to warrant a cautious beginning.



Wooden Model of Cochin Port (water removed) showing "swinging" berths in Mattancheri Channel before they were altered to the "Fore and aft" system

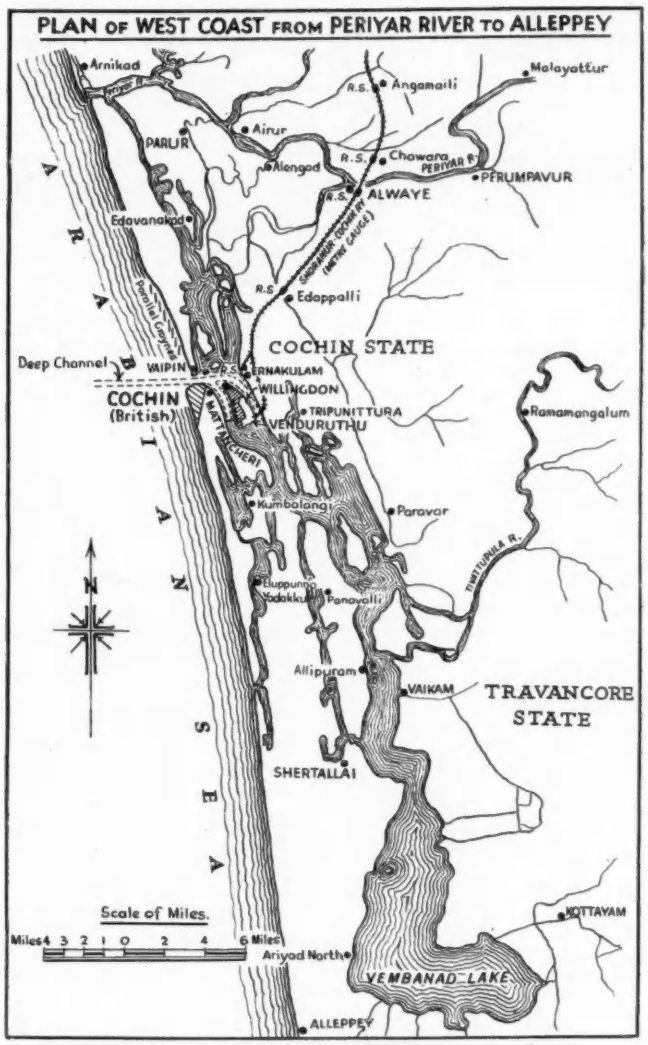
When I arrived in India on 4th April, 1920, the history of the argument for developing Cochin already dated back 88 years. A Mr. F. C. Brown of Calicut addressed the Madras Government on 5th June, 1832, calling serious attention to the potentialities of "Cochin as a place of Trade," and the letter was recorded in the Journal of the Royal Geographical Society, No. 111/268/1833. This followed 7 years of combined sail and steam development, the first little craft *Enterprise* having steamed into Table Bay en route for Calcutta on 13th October, 1825. (She was only 141-ft. long by 27-ft. beam by 464 tons nett.). The charts of Cochin date from 1835, though certain maps go back to the Portuguese and Dutch occupation, roughly 1500-1800 A.D. It is interesting to record that exactly 100 years after "Mr. Brown of Calicut" wrote his letter, the Governments of Madras, Cochin and Travancore accepted our scheme for the transformation of the harbour into a modern port, although the first cut through the bar had been made in 1928. Between 1850 and 1920, at least ten major reports by competent civil engineers had been written setting out the pros and cons of practicability, but the fact is that the key to the whole problem lay in the design of a suitable dredger, and it is very doubtful if success could have been achieved and maintained before about 1915-1920, by which time the requisite dredging knowledge and experience had accumulated.

As most people know now, there were two major problems at Cochin, the stopping of the foreshore erosion at Vaipin, which constituted a northern breakwater to the harbour system, and the dredging out to sea; and there were two schools of thought in each. In the first, one side advocated groynes at right angles to the coastline, and the other a continuous wall or revetment above low water. On the dredging question one side insisted that no channel could be dredged and maintained without the use of training walls, and the other that the dredging need not be very extensive; the ebb-tide from the vast backwaters, it was thought, would widen and deepen any gap that could be made in the bar, the surface of which was from 10 to 12-ft. below L.W.O.S.T. This represents the various views in the earlier days. The later reports dispensed with these early conceptions and concentrated more on the type of dredger required, but here again all was doubt and conflict, and rightly so; for every proposal was doomed to failure on four counts. There was as yet not enough data to design either dredger or pipeline or moorings nor were the local resources in skilled crews, workshops, docking facilities, fuel supply, etc., in any way adequate.

Thus there was plainly a need for an experimental stage during which a workshop and dry dock could be built and staffed, and a small bucket dredger could try itself out both inside the harbour and over the bar. We had time, too, to plan and develop our fuel and water supplies, to select many good men and weed out the

Port of Cochin, South India—continued

inefficients, to establish and train an office staff on proper harbour engineering traditions. In all this we started from zero, and with the barest resources financially. Always, at Cochin, our work had to be cut to the lowest possible minimum, and always the Accountant General, with untiring zeal, drew pointed attention to any variation from the hallowed past, and duly conveyed our ingenuous explanations to an inquisitive secretariat. For from the outset we had realised that if Cochin was to become a major port it must be self-supporting as to **maintenance;** that this depended on having a background of **experience;** and this in turn depended on doing the dredging **departmentally.** Thus we resisted every suggestion to hand over the capital dredging to contractors: we would



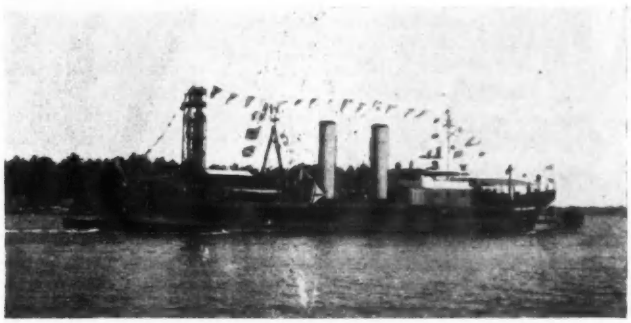
stand on our own legs from the beginning and grow with the job. Fortunately for me, my dredging and departmental experience at Portsmouth, Dover and Rosyth enabled me to convince the Government of Madras that this was the right solution, and indeed I never had, and never want, a better staff than the one we built up in this way.

How we stopped the Vaipin erosion with parallel groynes in echelon formation, discovered the secret habits of the ebb tides from the north and south backwaters, traced the movement of sand on the foreshore from season to season and carried out the experimental works in 1920-1923 may be read in vol. 230 of the Proceedings of the Institution of Civil Engineers. Never were three years better spent and better rewarded, for we had proved our case for a deep harbour, trained the men who were to build it, and acquired at nominal prices enough plant and buildings to form a nucleus of harbour facilities. When, next year, the small dry dock was satisfactorily opened we felt more or less secure. But, even more important, we knew by experience what seas and currents we might expect all the year round, what months of the year should be allocated to dredging inside and outside the harbour, what power would be required on the new dredger, what special conditions would govern its design, and what moorings it would demand, as well as the size of vessel to handle them. We knew the type of pipeline that would suit the dredging outside and the reclamation inside (for the spoil from the deepened mooring areas was to create a new island for port development) and even beyond all these we had found the right men to become dredging masters and serangs. How true it is that "the dredging master is the key."

The outcome of all this preparation was the design of the magnificent vessel, the *Lord Willingdon* which, to the best of my knowledge, is still the most reliable, and holds the best records of all similar craft. This is what we needed from it:

(1) To dredge a first channel about 2½ miles long, by 400-ft. wide by 32-ft. deep at low water spring tides in one dredging season of four months, or in two seasons at the most, the dredger also cutting "its own floatation" elsewhere.

(2) To dredge "free-getting" material at the rate of 1,500 cubic yards per hour measured *in situ* and pump it a distance of 1,500 yds.



The dredger *Lord Willingdon*. Note spuds at stern

(3) To withstand when dredging at full power the impact brought by an immovable obstacle against the suction cutter head, and to dredge up such things as old cannon balls and jettisoned cargoes buried in the sand over the bar (such as we had found in our experimental dredging), and deliver them safely to the end of the pipeline.

(4) To work at full speed in a 2-ft. swell and to achieve an average pumping time of not less than 6 2/3 hours in a 12-hour working shift. (Founded on experience elsewhere).

(5) To withstand the intial heavy roll of the swell over the bar before it was cut through.

(6) To float on the bar at all stages of the tide—a precaution against accidental grounding.

(7) To do the dredging at an average cost of 2¾ annas per cub. yard *in situ*, including docking and major repairs, but not sinking fund and interest, and overhead charges on superior staff, offices, dock, workshops, etc., etc.

And this is how it worked out in practice:

(1) The first year (1926-7) brought a series of "teething-troubles" and we were lucky to be able to establish beyond doubt the essential suitability of the dredger itself. But the ball-joints on the pipeline had to be redesigned and a better system of moorings discovered. Nevertheless we cut through the bar and never again experienced that formidable "roll."

(2) Our dredging rate was 700 cub. yds. per hour in the densest packed sand on the bar (like soft sandstone to dredge), 1,600 cub. yds. per hour in mixed alluvial soils, and up to 5,000 cub. yds. in soft clay.

(3) We pumped and discharged successfully cannon balls, bundles of hoop iron, granite rubble, bags of rice, coins and much other buried miscellanea.

Port of Cochin, South India—continued

(4) This requirement was easily met, but it was discovered that swells up to 4-ft. in November, December, February and March might be encountered.

(5) What saved us here were the spuds which we let down alternately to steady the stern against a cross swell, dredging on side wires the while. We smashed each spud in turn at bed level but they saved the situation, and my one great fear was removed.

(6) We had no trouble of this sort.

(7) The cost was comfortably within the estimate.

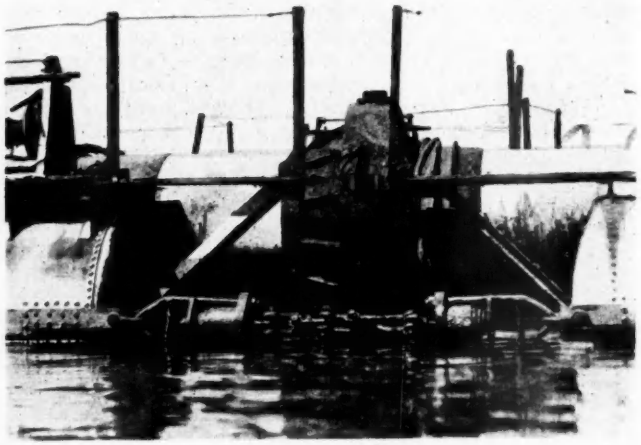
But this is only the barest outline. I would again refer readers to the Paper mentioned above for details.

The next year (1927-1928) we made a rapid recovery from our partial setback and achieved a dramatic success by dredging the whole channel to 32-ft. below L.W.O.S.T. in less than four months' day and night work, and this after a heavy storm had wrecked and sunk four of the pipeline pontoons. We finished it on 30th March, 1928, just before the sun broke through a heavy grey

Stern connection showing spigot end of gimbal-ring type of joint

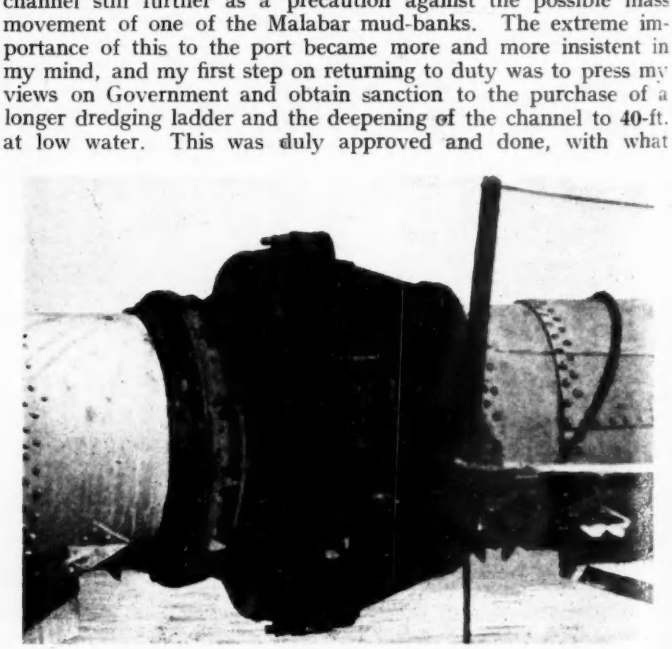
sky which had hung over us all morning like a pall; but not only the sun: around it was a perfect corona, clear and brilliant, at a distance of two or three diameters, a wonderfully cheering phenomenon.

Next season we tackled the task of enlarging this **first** channel. It was lengthened to three miles, widened to 450-ft. and deepened to 35-ft. at L.W.O.S.T. We started early in December and finished on 13th March, 1929, 15 days ahead of our original estimate of 1924, having dredged 2,801,910 cub. yds. in 86 days of 20 pumping hours each out of the daily 24. The total dredging output from the autumn of 1926 to the spring of 1929 was, nearly enough, 10 million cub. yds. *in situ* at an average cost of 2.72 annas per cub yd. against our original estimate of 2.75 annas. This included for the dredging and reclamation inside the harbour, a great portion of it consisting of solid beds of oyster shells, which scored the pipeline heavily and necessitated much renewal work. The material dredged outside, with the exception of a small portion done by a trial suction hopper-dredger, was discharged by pipeline into the open sea sufficiently far away to prevent its return to the channel except in minor degree. Our maintenance work in the outer channel was estimated to take two months yearly. Actually it took 6 weeks the first year and then progressively less until, after a few years, we got it down to 3 weeks or little over, and its cost an anna or thereabouts per cub. yd. In these 3 weeks we usually reckoned on clearing out about 2,000,000 cub. yds. of silt. Need I add, after this, that we paid a moderate bonus on output during the capital works and that it worked handsomely for all concerned?



Pipeline Details
(Cylindrical pontoons)
Gimbal—ring type showing " bat-pin " connection and sliding groove. Note also volute springs on cylinder connections

In 1929 I was placed on medical leave for 12 months, afterwards extended to 18, having for nearly two years suffered from acute insomnia. During this long period of rest and recuperation it was possible to dwell quietly on the major problems ahead; and there gradually emerged a conviction that we should deepen the channel still further as a precaution against the possible mass movement of one of the Malabar mud-banks. The extreme importance of this to the port became more and more insistent in my mind, and my first step on returning to duty was to press my views on Government and obtain sanction to the purchase of a longer dredging ladder and the deepening of the channel to 40-ft. at low water. This was duly approved and done, with what



(Clam pontoons)
Ordinary Ball and Socket type showing easy method of jointing and unjointing

results will appear in due course, and I was satisfied that we had indeed " left no stone unturned " in our policy of dredging security first and foremost. The extra maintenance, when there was any, made little difference in our annual " sweep." In addition to this vital element of security, constant reflection on the future of the port brought a programme of development vividly

Port of Cochin, South India—continued

in sight, and also the means whereby this could be justified and executed in stages as the port grew. It was unnecessary to put pen to paper; the picture of the port as I saw it was firmly engraved in the imagination and except for some of the emergency intrusions of war, was duly realised.

We must now go back to the technical history of the great reclamation known as Willingdon Island, which is about 900 acres in extent and placed between the harbour mouth and the mainland of Ernakulam at the confluence of the two main channels of Mattancheri and Ernakulam. The full story of this Island, from the time of its conception to its use in the late war, and after, would make fascinating reading, and will I hope be told at some future date. Unfortunately, the high pressure at which we all worked gave us little time to keep specific records of much that happened, and would be of interest historically to large numbers who are not conversant with engineering details. Here I must be content with these details alone. First, as to its site. Quite clearly, we needed an area of water into which to pump the spoil from the channels and mooring areas. Quite clearly, also, the tongue of land already in the making at the confluence of the two streams would be helpful, and could be reached from all parts by the pipeline. Estimates showed that, allowing for both capital and maintenance dredging, it would take ten years to fill up the whole area, which, at first, was limited to 640 acres. Other estimates indicated that by this time the port would be able to afford a different type of dredger, with hopper barges, to deal with siltage after the reclamation was full. It was a most valuable site with some 5 miles of water frontage. All these factors fitted exactly, like the pieces of a jig-saw puzzle.

The next step was to fix levels and design the retaining wall, and the first question which arose was: What is the minimum height of a wharf at which a vessel of say 26-ft. draught and 6,000 tons gross can moor directly alonside, with 3-ft. rise of tide in quiet water? After seeking a number of precedents we fixed this at 6-ft. above high water springs. Then, remembering the great advantage of having a natural cross fall to assist drainage we set up a centre line to the island 2-ft. higher. The average depth of the water over the site was roughly 3-ft. at low water and we reckoned that with compression at 1-ft. we should pump an average depth of 11-ft. of material over the whole area. Then we set out the lines with bamboos and red flags moored with a stone, and probed the bottom: very soft in some places, medium stiff in others and oysters or dense sand in others. So we began to think about the wall. First, a few borings corroborated the probings. Sheet-piling? Much too expensive. Concrete? Too expensive and rigid on such a foundation. Rubble? Heavy, with a lot of sinkage. Rubble on fascines? Here we seemed to have reached a solution, remembering of course that the deep-water wharves would be specially, and separately, designed. There was unlimited rubble (gneiss); for fascines we could bundle the stems of trees and float them on to the site. We decided to adopt this experimentally with a wall reaching up to 2-ft. above high water springs founded on a rubble mound up to low water springs sitting on fascines about a foot in diameter and 20-ft. wide. These latter were tied together in square rafts, and in single or double layers according to the nature of the bottom. At one part, I think we had to use three layers. Later the wall was backed up and raised to 5-ft. above high water, and then to 6-ft., but there was a certain amount of uneven sinkage over a long period of years which we made up under the maintenance estimates from time to time.

We set up profiles of the rubble wall and sunk the fascines with rubble. Then the wallums came along and dropped the stone over the fascines until the mound reached low water. On the mound the masons built a hand-packed rubble wall and the cost of all this was about 17 shillings per lineal foot of wall up to the height of + 2 H.W.O.S.T. The stone itself cost roundly seven or eight rupees per 100 cub. ft. delivered from quarries some 5 miles distant by backwater and canal. When we started pumping it was soon obvious that although the pipeline terminal was often hundreds of feet away, the material in suspension flowed through the wall, and this we had expected and desired up to a point, for the heavier elements formed a supporting bank on the outer face which was an advantage rather than otherwise; but we found the loss too great when pumping very fine stuff, and so covered the inside of the wall with palm-leaf matting spiked and wedged into the interstices, and so effected a very useful saving of material at a cost infinitesimal in the scale of the dredging expenses as a whole.

Nothing was more remarkable than the way in which the pipeline crew mastered the technique of handling the shore pipeline to secure a fairly level surface with material of widely different consistency. We used no heavy valves for diverting spoil from the pipeline "arm" to any of its "fingers," but merely slipped in a circular baffle plate or bolted on a blank end as required. But in dredging any particular area we found it was advisable to work out the position of the pipeline at the several stages of advance so that the "bag" and the bends brought no improper strains on the ball-joints, whose angle of swing vertically and horizontally was first 12 degrees and, after the first season's work outside, 18 degrees.

The mouth of Cochin Harbour looking west from the British Residency. A "wallum" in the foreground

One very interesting result of the dredging was the almost immediate clothing of the island with verdure. We had already considered the use of "binding" grasses and actually sown the seed of it, but nature laughed at our puny efforts and after each season's dredging there soon developed rich acres of Indian grasses with various kinds of trees, chiefly of the legumen family. The reason for this undoubtedly lay in the fact that, as much of the work was done during the monsoon periods, the flood waters brought down vast quantities of seed and these were duly distributed by the pipeline. A very highly qualified expert differed from us in this and explained that it was the **birds** who so liberally brought and scattered the seed. The fact that the birds were not many, and that a matter of some 50 or 60 acres would suddenly clothe itself a few months after the dredging season in which that particular area had been formed, did not seem to have any botanical significance.

The reclamation hardened very quickly except when we came to pump the silt which was to accumulate in the channels later. This shrank into a crazy pattern of blocks, a foot or two wide, with cracks between, which widened as much as 2-in. or so. It was probably one of our greatest pleasures to walk a few miles through these grasses and trees, often knee high, or higher, especially during the hour before sunset on Sundays, when all was still. At the southern end of the island we often noticed how the hot, humid breeze that came over the sea from the northern end had cooled and dried itself in its unbroken travel of 2½ miles.

Let me conclude this section by referring readers to pp. 50-52 of vol. 230 of the Proceedings above-mentioned for particulars of the dredging plant. Briefly, it consisted of a 42-in. suction cutter dredger discharging through a 39-in. pipeline, and it cost, in 1925, £90,000 for the dredger and £60,000 for the pipeline. It burnt oil fuel, and the pumping engines were of 2,500 h.p., it was twin screw and could steam at 9 or 10 knots.

Port of Cochin, South India—continued

An outline specification was first given by ourselves and this was worked out in detail by Messrs. Sir John Biles & Co. Tenders were invited and the Contract was awarded to Messrs. Simons & Co., of Renfrew, whose quotation was lowest. We borrowed part of the money from the Madras Government who charged us 5 per cent. interest plus 1½ per cent. over a redemption period of 30 years for this and other loans. The estimates as a whole will be given in a concluding article.

There falls into this period the design and laying of the cargo ship's moorings, which of course were put down immediately the inside channels had been prepared. I select this as illustrating a problem in which a Dock and Harbour Authority has sometimes to choose between conflicting expert advice. In our first designs we had shown a series of fore and aft moorings alongside a channel 600 to 800-ft. wide, and a few "swinging berths" (one buoy) in a part of the harbour where existing depths over a large area permitted their use. These swinging berths were found so convenient to the ships and pilots that when the time came to put down the fore and aft berths the Port Officer objected on the ground that the ships' after-lockers contained no chains and it would become necessary to drag them aft along the deck out of the fore-lockers. When asked why wire ropes could not be used he said it would not be safe, and as he was responsible he could not agree to it. The fact that the *Lord Willingdon* used wires on all her moorings which were daily exposed to stresses greatly in excess of any that would occur in an after mooring, whether on the ebb or flood, made no appeal to the Port Officer, whose views were upheld by the then Presidency Port Officer, and who, of course, was directly responsible to the Government. Now the provision of swinging berths for ordinary purposes meant having a channel 1,000-ft. wide and a reservation in the channel of 1,000-ft. of space fore and aft for each mooring; and this in turn, apart from the expense of dredging, meant widening the channel beyond its critical width as a self-scouring or partly self-scouring agency. However, knowing that the Madras Government were bound to accept the view of the navigational authority, we decided not to force the issue, and against our better judgment consented to the arrangement for the time being. Later, of course, the pilots found out for themselves that it was better in every way not to have a row of ships swinging in all directions when the tide turned, and they had to take a ship in or out, and were only too pleased to adopt the so-called "dangerous" practice of mooring fore and aft with chain and wire ropes respectively.

As to the type of moorings, we had long before decided that by far the cheapest and simplest buoy was the flat "drum" type used by the French at Marseilles and Port Said, but the design of the anchorage was more difficult.

At the berths first available the bottom was very hard and we decided to sink a screw mooring 15-ft. deep into the ground and to shackle the buoy chain on to it directly. This work was done very cleverly by Messrs. Braithwaite & Co. with a neat adaptation of their electric capstan plant. In our next series of moorings, however, the ground was much softer, and as we had a good deal of spare chain and some anchors available, we put down the ordinary safe and sound "St. Andrew's Cross" mooring, with a 12-in. centre ring to take the buoy chain, and four smaller ones to act as the cross. Later, we fixed a crane with a long jib on the end of a pontoon and so lifted the whole mooring in one operation. This greatly assisted periodical examinations and the annealing of chains. I should mention, moreover, that our first mooring, at the mouth of the harbour, failed in an extraordinary manner, the pin of the shackle working loose where the buoy chain was connected to the screw pile in the ground. Examination showed nothing wrong with the shackle. The pin had been well set in and securely fastened and counter-fastened at the end through the jaws of the shackle, but the constant fret of swell in that position had knocked the shackle loose. This happened twice and gave us a convincing reason for abandoning both the berth and the screw mooring.

I have never seen quicker mooring anywhere than at Cochin. As the ship approached her buoy she hung out a hemp or manilla rope on one side of the bow and a wire on the other. A small mooring launch darted forward, a lascar took the rope and sprang with it on the top of the buoy, making it fast with a "toggle." Poking its nose round the stem of the ship the launch reached the wire which was immediately shackled next the rope. Then the latter was slipped and the mooring chain dropped, to be shackled next the wire. If the tide or wind were difficult, the hemp or manilla rope was strong enough to draw the ship gently up to the buoy with a touch ahead on the ship's propellers. Unmooring went on in reverse order and the whole operation often took no longer to carry out than it does to describe in writing. Our little mooring launch won much appreciation from sailors watching this operation, though an impatient German skipper of one of the Hansa boats once jammed the launch against the buoy at night when leaving in a hurry, and so overturned and sank it, with one of the crew as a victim. We fished it up next day, none the worse, with the bow winch and the ladder suspension bracket of the *Lord Willingdon* as hoist. And "Hansa" paid the cost and compensation charges. I think it was the same skipper who, on mooring alongside our newly-constructed wharves in 1938-9 said that it was all very good, and that they would be "taking it from us in a year or two." Afterwards he was bottled up in Goa and what became of him eventually is not known.

(To be continued).

Belfast Harbour Commissioners

Excerpts from the Annual Report for the Year 1946

The Statement of Accounts for the year 1946 shows a gross revenue of £526,044 12s. 8d., a total expenditure of £519,698 16s. 2d.and a net surplus of £6,345 16s. 6d., after making the usual allocations to Sinking Funds and Statutory Borrowing Bank Account.

Following the conclusion of hostilities there was a large falling off in trade. This, combined with the rising costs of wages and materials, has had a serious effect on the financial position. In view of this the Commissioners transferred the sum of £47,265 7s. 10d. from the Freight Rebates Account to revenue. Had this sum not been available, the increase of 15 per cent. which the Commissioners were obliged to make in Harbour Rates on vessels and goods as from 1st January, 1947, would have had to be imposed early in the year 1946.

The net register tonnage of vessels cleared during the year was 4,083,496 tons, being 451,227 tons (10%) less than that of 1945.

The tonnage of goods imported and exported amounted to 3,926,410 tons, a decrease of 39,340 tons (1%) on last year.

New tonnage constructed in the shipbuilding yards on the Harbour Estate and cleared during the year comprised 17 vessels of 159,902 tons gross and 103,058 tons net register.

The Belfast Corporation having intimated to the Commissioners that they proposed to instal additional generating plant at the Harbour Power Station, Musgrave Channel, to meet the growing requirements of the installation, the Commissioners, at the request of the Corporation, decided to widen, by 15-ft., the wharf adjoining the station; extend it northwards by 72-ft. 6-in., and to deepen the berth from 17-ft. to 23-ft. at ordinary low water, and the work is now in progress.

The termination of hostilities found the Commissioners faced with an accumulation of maintenance work which will require some time to overtake, but, despite the difficulty in obtaining materials, considerable leeway has been made up during the year.

Belfast Harbour Airport is still held under requisition by the Air Ministry, and scheduled air services were regularly operated from the Airport until December, when they were transferred by the Ministry of Civil Aviation to the Government's Airport at Nutt's Corner. The Commissioners made strong, but unavailing, representations to the Minister of Civil Aviation for the retention of the scheduled air services at Belfast Harbour Airport in view of the proximity of the Airport to the City and of the great service it was rendering to the general public.

Ice Blockade of Canadian Ports

The Winter Temperature Cycle of the St. Lawrence Waters · A Plea for More Data*

By J. G. G. KERRY, M.E.I.C.

Introductory

THE boundaries of the Dominion of Canada are such that all its area lies within a section of the earth's surface that annually gives off more heat to outside space than it receives from the sun and from other celestial radiation. This fact means that the Canadian climate would steadily grow colder were it not for the counter-balance supplied by air movements of very great magnitude from more favoured sections of the earth.

Ice Jam at Montreal Harbour

The staff of the Scripps Oceanographic Institute in their book, "The Oceans"[13] make the following estimate of the daily gains and losses of heat energy at various latitudes, the quantities given being in B.T.U.'s per sq. ft. per day:

Latitude	Heat Gains	Heat Losses	Net Loss or Gain
30	1578	1504	+ 74
40	1419	1446	— 27
50	1233	1371	—138

In view of these geophysical facts it is natural that all questions concerning the formation of ice and snow should be of great interest to every construction engineer practising in Canada, for he must deal with these obstructions sooner or later. It was fitting that the first paper read to the Canadian Society of Civil Engineers dealt with the formation of frasil ice.

This present paper contains a brief review of certain sections of the available data upon which the practice of what the late Dr. Barnes called "Ice Engineering" is based—the history of the engineer's struggle in Canada against these major obstructions is briefly related, present-day knowledge or rather lack of knowledge of the life history of float ice on the Great Lakes is considered, the winter temperature cycle of the waters of the Great Lakes, both surface and sub-surface, is discussed and the causes that make these waters lose or gain heat energy are analysed. The writer's conclusions are that data on these major problems are woefully lacking, for no major scientific study appears to have been made at any time covering the formation and dissipation of sheet ice on the Great Lakes, only one scientific study of the depth temperatures of their waters has been published and on only one of the Great Lakes have the temperatures of the surface waters been systematically recorded over a period of years. Finally, no estimates have been made of the heat energy contained in the waters of the Great Lakes at various dates throughout the year nor has any study been made of the possibility of beneficially utilising this heat energy. It is hoped that the publication of this paper will lead to greater activity on the part of proper authority in the collection and publication of the needed data.

*Paper presented at the Sixtieth Annual General Meeting of the Engineering Institute of Canada, at Montreal on February 8th, 1946, and reproduced by permission.

History

Historically the struggle against the forces of ice and snow has been active for a century past and one gain after another has been achieved by the profession. Along the St. Lawrence waterway, perhaps the first notable step was the construction of the old revetment wall in front of Montreal by the Royal Engineers in the early 1840's when, for the first time, the moving ice sheet met up with a piece of construction that it could not overthrow. The writer has seen ice piled up sixty-odd feet deep on the old low level wharves in Montreal where the spring shove had crashed against the masonry of the now buried revetment wall.

A second step was the construction of the Victoria Bridge in the late 1850's by the engineers of the Grand Trunk Railway. Even to-day it is a pleasure to watch the moving ice sheet shattering itself to pieces against the highly developed cutwaters of the old bridge.

The Montreal Flood Commission (1889) made extensive surveys of the ice conditions around Montreal, but the complete success of the simple remedy that the Commission recommended for the protection of the city has caused other remedies that the Commission was considering to be overlooked.

The high level piers and the Guard Pier in Montreal were to some extent the outcome of the Flood Commission's work, as Mr. John Kennedy, M.E.I.C., the chief engineer of the Montreal Harbour Commissioners, was also a member of the Flood Commission. After the completion of the Guard Pier about 1895, vessels could, for the first time, be safely wintered in Montreal Harbour.

Mr. Kennedy also introduced in the 1880's the practice of taking daily observations of the water temperatures in the harbour with

Ice Breaker at Work in the St. Lawrence

an especially protected thermometer. Sailing vessels were not unusual visitors to Montreal in those days and Mr. Kennedy depended upon his records of water temperatures when he had to decide when to issue warnings to the vessels in port that it was time for them to take final leave for the season or be frozen in. It was also at Mr. Kennedy's direction and at the expense of the Montreal Harbour Commission that Dr. T. Howard Barnes,

Ice Blockade of Canadian Ports—continued

M.E.I.C., commenced his long series of experiments on water temperatures and ice formation, definitely confirming to the profession the fact that running water never falls sensibly below 32 degs. F. in temperature during the winter months and that a very slight rise in the temperature of the mass destroys all the adhesive qualities of frasil ice.

Dr. Barnes' report resulted, amongst other consequences, in the patents taken out by Mr. John Murphy, M.E.I.C., Superintendent of the Ottawa Electric Company, who, in the operations of his company's plant at the Chaudière Falls on the Ottawa River, had then to deal with one of the most difficult ice situations in Canada. The successful result of Mr. Murphy's use of heat as a correcting agency is fully described in his paper presented to the Canadian Electrical Association in September, 1907. So far as the writer knows, no other engineer has as yet made use of heat on a similar major scale in the battle against ice.

The first extensive study of ice conditions along the entire St. Lawrence waterway appeared in the report of the U.S. Deep Waterways Commission which was presented in 1897.

No further studies of the ice problem appear to have been made until the growth of the demand for hydro-electric power resulted in the preparation of the Bowden-Wooten Report on the St. Lawrence Deep Waterway which was presented in 1921. This was followed by the Report of the Joint Board of Engineers which was completed in 1926. The Joint Board made extensive studies of the temperature conditions in the St. Lawrence river during the early weeks of winter.

During the last ten years the Dominion Meteorological Service has made an extended series of observations upon the surface temperatures of the Great Lakes, which study is still being carried on.

During this time apparently but little attention has been given to two main problems affecting the design and use of the waterway, namely—

1. The control of float ice and the possibility of its exclusion from the major navigable channels.
2. The control of the temperatures of the water in the rivers issuing from the Great Lakes.

Sheet Ice

So far as the writer knows, no extended survey of ice formation and ice movement has ever been made on the Great Lakes and the subject is too vast to be undertaken by other than a government department or a privately endowed scientific institute.

Modern science has placed at the disposal of the profession the equipment and machinery with which such a survey could now be easily and not expensively carried out. It should cover with scientific accuracy:

1. The locations and date of the major formations of sheet ice.
2. The causes that make such ice break away from its moorings and the paths, if any, along which it normally drifts.
3. The possibility of designing and constructing detour channels so placed that drift ice will not normally enter into them.
4. The possibility of confining sheet ice to its area of formation and of creating barriers that will close the natural channels through which drift ice frequently passes and from which it finds its way into the regular channels of navigation.

The Montreal Flood Commission gave some thought to the control and permanent anchoring of what is known as " bordage " ice in the province of Quebec—Mr. T. C. Keefer, M.E.I.C., the first engineer of the Montreal Ship Channel and the chairman of the Montreal Flood Commission, was convinced that the control of " bordage " was a reasonable engineering undertaking and he is on record as stating that if the surface of the St. Lawrence River between Montreal and tide water could be kept as clear of float ice as it actually is between Lake St. Louis and the Lachine Rapids, no difficulty would be experienced in maintaining winter navigation over the section of the waterway between Montreal and tidewater.

The rate at which ice forms along the waterway and the thickness to which it grows are reasonably well known and these facts are illustrated by the curves appearing in Fig. 1. The origins of the curves shown are as follows:—

Curve A is a theoretical curve calculated by Dr. Barnes' formula, governing the growth of ice in thickness, and the calculation is based on an assumed air temperature of 14 degs. F.

Curve B is the result of a series of measurements made by the Greater Winnipeg Water District under the direction of the late Mr. W. G. Chace, M.E.I.C., in 1913-14 on Shoal Lake, Manitoba. An area 50-ft. by 100-ft. was kept clear of snow and the ice thickness was measured daily. The average temperature at Shoal Lake during December was 20.1 F., during January 8.2 F. and during February minus 7.2 F.

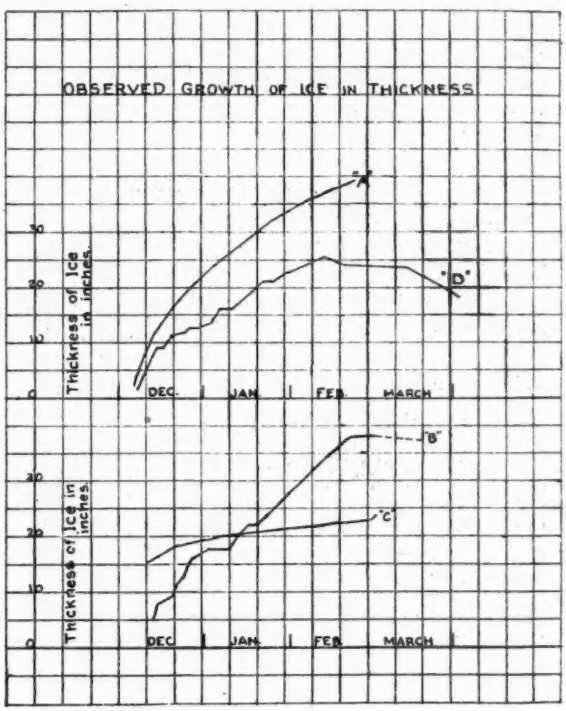


Fig. 1

Curve C is the result of a series of measurements also made by the Greater Winnipeg Water District under the direction of Mr. W. L. Scott in 1942-43 at the same place. The surface of the ice was not swept and measurements were taken weekly. The average temperatures were about minus 7.8 F. for January and plus 6.4 F. for February.

Curve D is the result of measurement taken by Dr. Barnes at Valleyfield, Quebec, in 1910-1911 and the surface of the ice was not swept. The average winter temperatures in Valleyfield were about 11 degs. F. in January and 12 degs. F. in February, 1911.

The following facts may be noted from Fig. 1:—

1. The insulating effect of snow cover as shown by the divergence of Curves B. and C and of Curves A and D.
2. The parallelism between Curves A and B although the air temperatures for Curve B during January and February were much lower than those assumed in the calculations for Curve A. The conclusion may be drawn that the rate of the natural outdoor growth of ice is very appreciably slower than is the same growth under laboratory conditions.
3. The rapidity of the formation of the first few inches of ice. Dr. Barnes' estimate of the time required to form an ice sheet 1-in. thick with an air temperature of 14 degs. F. is very slightly over two hours.

No study as yet appears to have been made for the design of piers and booms to prevent sheet ice from breaking away from its place of formation as contemplated by the Montreal Flood Commission nor has the possibility of using ice as a controller of ice been given attention. There are few engineering structures that can be formed

Ice Blockade of Canadian Ports—continued

more simply and more quickly than a heavy field of ice; suitable site and air temperatures with an efficient pumping equipment is all that is required for over-flooding and very rapid thickening. Yet a heavy snow-covered sheet of ice can serve as an excellent insulator as the curves in Fig. 1 show; it can be made use of as a formidable barrier with which to block and prevent the movement of other ice; and as it is floating it can be moved at will with suitable equipment to any location where it can be of service. Data are not now available concerning the strength of a great ice

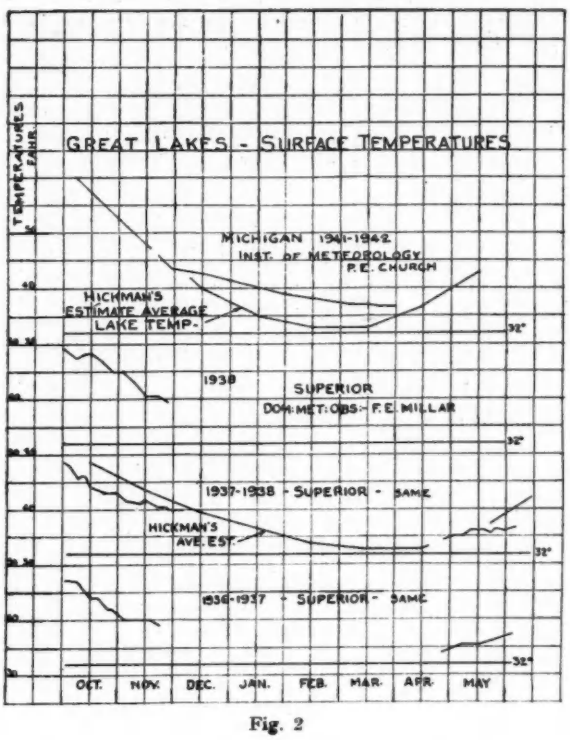


Fig. 2

sheet or of its ability to resist the action of winds and waves. Considered solely as a heat problem it appears likely that ice will not form in quantity on the Great Lakes at any point where the waters have a depth of 200-ft. or over. On the other hand, thicknesses exceeding the 38-in. measured by W. G. Chace at Shoal Lake will rarely be exceeded where the ice is undisturbed, Shoal Lake being both very shallow and very exposed. The formation of surface ice seems to depend mainly upon the depth of the waters and upon the activity of the winds. In general, ice does not form over deep waters but will do so on occasions more or less frequent if by some change in the winds the activity of the internal currents within the waters is checked.

Present-day knowedge of the actual ice conditions far out on the Great Lakes can be described as being decidedly vague and is summarised by the following quotations from a bulletin issued by the American Meteorological Society in 1944: " Do the Great Lakes freeze entirely across? Aviators flying from Ontonagon, Upper Michigan, to Ile Royale have reported solid ice all the way and on to Canada, but it is believed that there is always some open water in Eastern Lake Superior—Lake Michigan after freezes across the north and where there are islands. Railroad car ferry captains report Lake Michigan as frozen over between Milwaukee and Muskegon only once in 25 years of sailing and then for only one day. . . . There appears to be no information that Lake Huron has frozen across except at the south end of the lake. The narrow eastern end of Lake Erie freezes across, probably every winter, and this is true around and to the westward of the islands. . . . . Lake Ontario was frozen entirely across during the winter of 1933-1943; this is the first time on record that such a condition has been reported." This is surely vague information after more than one hundred years of active navigation.

One definite fact has been contributed by the year 1945—in the first part of January several new merchant vessels left Duluth and made their way without difficulty to Sault Ste. Marie. These vessels were assisted by ice breakers when leaving Duluth and while passing through the St. Mary River, weather conditions at Sault Ste. Marie were very severe, the thermometer registering about 15 degs. F. below.

The progress in the art of communication made during the late war, especially for aviation service, makes it now possible to keep the Great Lakes carriers warned of nearly all the more serious dangers that beset navigation, such as winds, storms, fog, sleet, and approaching vessels, leaving float ice as perhaps the most serious problem calling for further study. How serious this problem is may be judged from the following extracts from an address given in 1943 to the Royal Meteorological Society of Canada by C. G. Andrus of the United States weather Bureau:[14]

" The season opens when the ice floes are cleared from the lanes of navigation in the Spring; it closes when iced cargoes and iced harbours combine with the icing of ships to retard movements. In season every ship races continuously up and down the lakes as freely as sea and weather permit. . . . Ice may be classed as derelict material quite beyond human control—floating in great masses, it drifts and packs with the wind and its fields break up and recombine into windrows as wind and current dictate. . . "

It would now appear to be opportune for proper authority to adopt the policy of the Montreal Flood Commission and to find out by scientific observation just how far this menace can be brought under control. It need not be accepted as an Act of God against which there is no hope of defence.

In those sections of the Great Lakes that are shallow and where the cooling off of the mass will be complete at relatively early dates, surface ice of appreciable thickness will form and those engineering studies may prove most productive of results that are

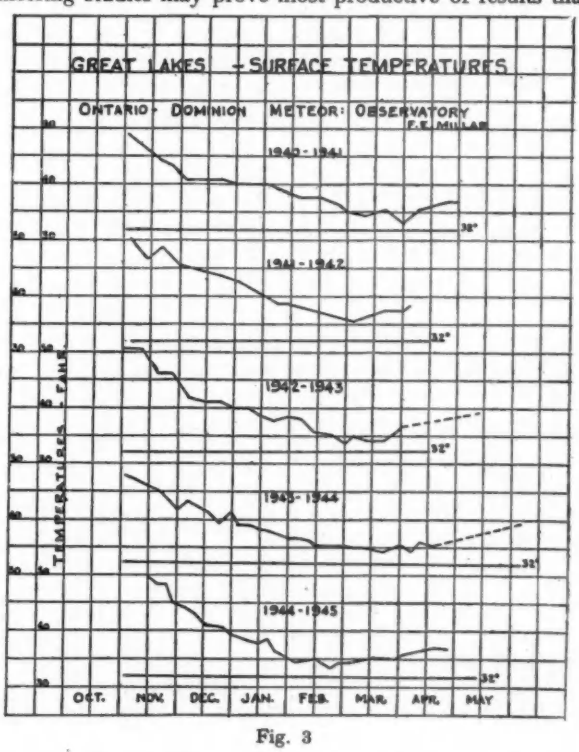


Fig. 3

directed to confining the ice to these formation areas or at or near to their place of origin.

In the major gathering areas of float ice such as Whitefish Bay and the southern end of Lake Huron the best promise of relief would appear to be in the construction of detour channels in which the entire discharge of the feeding lake could be confined during the winter months. Until the subject has been scientifically studied no more can be said.

Ice Blockade of Canadian Ports—continned

Sub-Surface Temperatures

The studies made by Mr. P. E. Church[2] for the Institute of Meteorology (University of Chicago) in the winter of 1941-1942 show that the surface waters of Lake Michigan remained at a temperature above freezing point all through that winter and that the water temperatures at depth coincided almost exactly with those on the surface. Figure 2 shows the surface temperatures observed by Mr. Church about the centre of the lake and their change with date. Fig. 3 shows a series of depth temperature observations also taken by Mr. Church at about the same place. The measurements were made from the car ferry of the Grand Trunk Western Railway operating between Milwaukee and Muskegon and were taken with recording depth-temperature apparatus that had been developed at the Wood's Hole Oceanographic Institute (Wood's Hole, Cape Cod—Massachusetts Institute of Technology). In Fig. 4 are shown water temperature curves as observed[3] in Lake Mendota, Madison, Wisconsin. Madison lies about 80 miles due west of Milwaukee on Lake Michigan. The temperatures shown are averages and are the result of sixteen years of observation by Dean Birge and Associates. The noteworthy factors are the uniform temperature existing throughout the lake at all depths during the month of November and the temperature gradients that developed just before the freeze-up came. The slow rise in temperature throughout the lake that that commenced when the freeze-up took place and that continued all winter should also be noted. In Fig. 5 are shown the results of temperature observations made on Lake Vattern, Sweden.[4], in 1910 in which the practically uniform distribution of temperature is shown to continue well into the Spring months. Lake Vattern is situated at Lat. 58 degs.; it is about twice the size of Lake Champlain and of an equal depth. The average annual temperature is about 2 legs. F. lower than that of Madison. Ice forms on this lake.

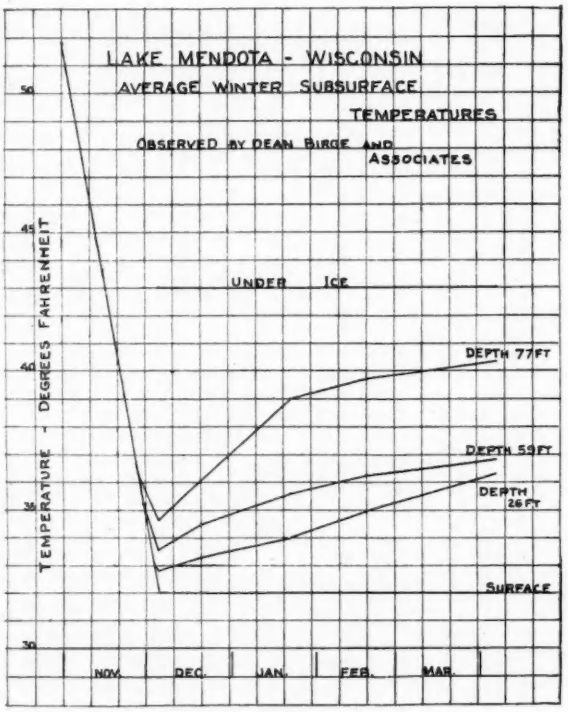


Fig. 4

Mr. Desmond Fitzgerald[5] in certain papers read to the American Society of Civil Engineers in the 1880's and 1890's, was the first to advance the theory that lake waters cool down gradually in the fall until the whole body of the waters has a temperature of 39.4 degs. F., and he argued that when in that condition the waters are very likely to be agitated throughout their depth by winds, there being no differences in weight among the water particles to check movement within the mass. On further cooling, the waters show temperatures steadily if slowing increasing from top to bottom. On Lake Michigan, Mr. Church's observations[2] show almost uniform temperatures as early as December 7th, when the water temperatures were about 43 degs. F., and this condition of almost uniform temperature continues down to Mr. Church's latest observations taken on March 30th when the water temperatures were about 36 degs. F.

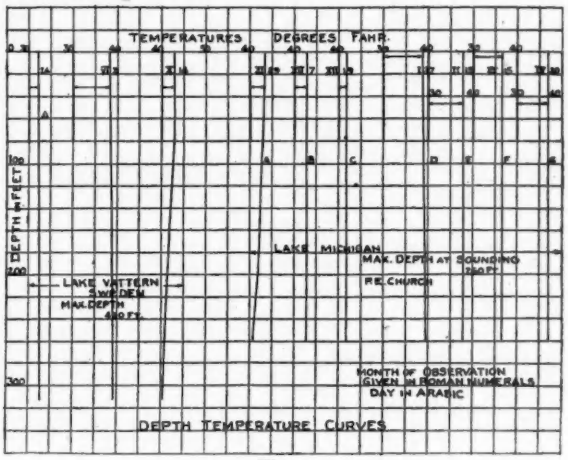


Fig. 5

The fact that the waters of the Great Lakes do not show any tendency to cool off first at the surface during the winter months is thought to be due to the constant activity of the winds in creating and maintaining internal currents. Wind is the normal air condition over the Great Lakes in winter and calms are definitely a rarity. Meteorological opinion considers that intensity of any storm is in general considerably more severe when it is sweeping over a lake surface than as it is measured on the adjoining lands.

This condition of open water in spite of low air temperatures does not completely hold on Lake Champlain where on the " broad lake " the dates of the annual freeze-out run as follows:—

Freeze-up dates on the " broad " section of Lake Champlain:

1925.....January 20th	1930.....January 30th
6.....February 9th	1.....February 11th
7.....March 4th	2.....Not closed
8.....March 11th	3.....Not closed
9.....February 6th	4.....January 20th
	5.....January 20th

the dates being from a bulletin issued by the U.S. Weather Bureau in 1935 and containing a continuous record from the year 1816.

The " broad " lake has depths as great as 400-ft. but the lake is relatively narrow and is protected from wind both on the east and on the west by mountain ranges.

One fact stands out clearly on the entire record of sub-surface temperatures, namely, that no observations have shown in winter sub-surface water temperatures that are lower than the corresponding surface temperatures. In other words, surface lake temperatures are a sure indication of the minimum temperatures that will be found in the river outflowing from the lake, provided that the supply of the river is drawn from a deep section of the lake. Shallow shore waters always cool off quickly and early.

(To be continued)

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Pilotage in the Firth and River of Forth

Proposals for Single Authority

In a Report on pilotage arrangements in the Firth and River of Forth and at ports situated in the area, submitted to the Minister of Transport by Sir Robert Letch, it is recommended that a new pilotage authority should be created to supercede the six existing authorities. The Report gives a broad outline of the proposals, and a Reorganisastion Committee has been constituted to prepare the necessary draft Order and code of bye-laws. The Reorganisation Committee has already held a number of meetings and considerable progress has been made.

The present enquiry arose out of a resolution passed by the Forth (Trinity House of Leith) Pilotage Authority on the 24th July, 1946, which reads as follows:—" That in view of the lack of unity in the pilotage organisation of the Firth of Forth, which is inimical to the interests of pilots, the Minister of Transport be asked to enquire into the matter, in order to effect improvement in the present conditions."

It was decided to hold a conference of all interested parties, and this took place in Edinburgh on September 30th and October 1st under the chairmanship of Sir Robert Letch. The National and Local Organisations represented at the Conference were: Admiralty, Ministry of Transport, Trinity House of Leith, Forth (Trinity House of Leith) Pilotage Authority, Forth Conservancy Board, Pilots (representatives of the Transport and General Workers' Union), United Kingdom Pilots' Association and Licensed Pilots Shipowners, Leith Dock Commission, L.M.S. Railway Company, L. & N.E. Railway Company and the Town Council of Kirkcaldy.

The following are the six pilotage authorities now in existence:

Forth (Trinity House of Leith).

London & North Eastern Railway Co. (Pilotage Authority for Bo'ness).

London Midland & Scottish Railway Co. (Pilotage Authority for Grangemouth).

London & North Eastern Railway Co. (Pilotage Authority for Methil).

Kirkcaldy Town Council (Pilotage Authority for Kirkcaldy).

London & North Eastern Railway Co. (Pilotage Authority for Burntisland).

Referring to the problems under the existing arrangements and the proposals for re-organisation, it was stated at the outset that throughout the proceedings of the Conference no criticism was made or implied regarding the manner in which the existing Pilotage Authorities have administered the pilotage services since they were constituted in 1922, or of the way in which they have carried out their duties under the Pilotage Orders. Indeed they deserve praise for overcoming many difficulties and for maintaining an efficient pilotage service. Similarly no criticism was made at the Conference of the services rendered by the pilots and there is no doubt that the present officers are well qualified for their duties which they perform in an exemplary manner.

The problems which were examined at the Conference and which have hitherto been found insoluble are inherent in the Orders and arise from factors beyond the control of the authorities. The existence of six Authorities with separate Pilotage Orders and Bye-laws has led to the position that, while all the pilots are engaged in the common task of piloting vessels in the Forth, many of the officers are simultaneously under the control of their own local Authority and also that of the Forth Authority. The fact that each port is a saparate Pilotage District has tended to promote sectional interests amongst the pilots, and has militated against uniformity of system. The duality of control and other defects in the existing system have hampered the administrative machinery and have caused many difficult situations. Further, dissatisfaction has arisen amongst the pilots and there hase been protracted and expensive litigation.

Apart from these general criticisms it has already been observed that neither shipowners nor pilots have any representation on the local Authorities for Bo'ness, Grangemouth, Methil, Kirkcaldy and Burntisland. A further anomoly is that, while the local Authorities have representation on the Forth Authority, the Forth Authority have no representation on the local Authorities. The various Pilotage Orders and Bye-laws provide for consultation between the Authorities in a legal sense, but for practical purposes the means are valueless. As an instance, the Forth Authority have been advised that consultation with the local Authorities can only be effective if made through the Head Offices of the two Railway Companies, and that reference to the Companies' representatives on the Forth Authority is not sufficient.

The duty imposed upon the Forth Authority to licence candidates for all the ports as well as the Forth has led to many complications. A candidate for a licence or certificate for a local district must apply to the Authority of that District and that Authority, if they decide to sponsor the application must refer to the Forth Authority for the necessary action. The Forth Authority have, therefore, no power to determine the number of pilots required for a local District, but they have to grant a Firth licence to enable the pilot to take vessels out of the Forth irrespective of whether or not additional pilots are required for Firth duties. The local Authority thus transfers to the Forth Authority the responsibility of sharing to an appreciable extent the liability of providing the income of the pilot, and there is no doubt that some vacancies would not have been filled if the local Authority had been liable for the full remuneration of the pilot. Moreover, the present practice gives the candidate sponsored by a local Authority an undue advantage over candidates for Forth licences only, and deprives the Forth Authority of the right of selection of candidates. The general result is that, in the event of trade declining at a port, the number of pilots is automatically in excess of the requirements both in that port and on the Forth.

Creation of New Authority

After careful and detailed consideration of all the outstanding problems the representatives of the various interests at the Conference came unanimously to the conclusion that no satisfactory solution could be found within the framework of the Orders and Bye-laws now in operation and that it was essential to create a new Authority to supercede the six existing Authorities.

It was considered that the constitution, powers, and duties of the new Authority should be devised within the provisions of the Pilotage Act, 1913. Some of the representatives at the Conference desired to go further but they appreciated that any such proposals would require national legislation and were, therefore, beyond the scope of the Conference, as was also the general question of port administration in the Forth Area.

Constitution

The Pilotage Act, 1913, provides that, in the circumstances prevailing in the Forth, the Pilotage Authority should, at least, have representatives of the pilots performing the services: the principal Port Authorities providing the facilities in which the pilotage is, in part, undertaken: and the shipowners who pay for the services.

Under the existing Order for the Forth (Trinity House of Leith) Pilotage Authority, the Authority consists not only of representatives of the three interests mentioned but also of the Admiralty. Trinity House of Leith: and the Forth Conservancy Board: while the Chairmanship of the Authority is the prerogative of the Master of Trinity House. The criticism was made that the existing Authority is unwieldy in size and too diversified in representation and it was generally agreed that any new Authority should be substantially smaller in number.

The Admiralty interest is protected by the exclusion of the Admiralty Dockyard from the Pilotage District and by the fact that H.M. ships have statutory exemption from pilotage. Further, in time of emergency the Admiralty can exercise overriding control of the Pilotage Authority by Special Orders. On the other hand the dockyard area extends from shore to shore over a substantial section of the Forth through which commercial vessels are navigated. On balance, therefore, it is considered that the Admiralty might continue to have the right to nominate one member to the Authority.

The Trinity House of Leith have a long record of service in connection with pilotage on the Forth and around the coasts of Scotland, but under modern conditions this is not the type of organisation which should be involved in the administration of a commercial undertaking. The Trinity House are in reality a local society of shipmasters, with restrictive membership based on the

Pilotage in the Firth and River of Forth—continued

accident of birth or the good fortune to have commanded a ship registered in Leith and the main function of the Trinity House is to administer charitable funds for the benefit of their members and dependants. They are not a learned society devoting their time and money to the science of navigation and their funds are not used in any way for the benefit of pilots. With a single exception the pilots are not member of Trinity House and in the exceptional case the officer concerned was a member of the House before he became a pilot. He is now not only a pilot but also a member of the Forth Authority as one of the Trinity House representatives, which is an anomolous position.

There is no criticism of the way the Trinity House have carried out their functions as members of the Pilotage Authority and the Authority have undoubtedly benefited from the technical knowledge of the Trinity Masters in the examination of candidates for licences and certificates. In all the circumstances, however, it was thought that the Trinity House should not be given the right of representation on the new Authority.

The Forth Conservancy Board have one representative on the existing Forth Authority but it is considered that there is no need for this representation to be continued on the new Authority. The Board exercise conservancy functions in the river and are not directly concerned with pilotage matters. It should be noted also that the Commissioners of Northern Lighthouses whose functions in the Forth are, to some extent, similar to those of the Conservancy Board are not represented on the existing Pilotage Authority. Any inter-change of information between the Conservancy Board and the Pilotage Authority would be better done directly by the two bodies than by inter-locking representation.

There are five Port Authorities in the Area, viz.: Leith Dock Commission; London Midland & Scottish Railway Company; London & North Eastern Railway Company; Kirkcaldy Town Council; and Granton Harbour Limited. The first four are represented on the existing Forth Authority. Granton Harbour, Ltd., have apparently been content to leave their interests to be watched by the representative of the Leith Dock Commission.

With a view to reducing the size of the new Authority and having regard to the fact that the pilotage needs of Kirkcaldy are met by the part-time services of one officer (who is also the Harbour Master for the Town Council) it is suggested that Kirkcaldy should not be represented on the new Authority. It is also suggested that Granton Harbour Limited should not be represented, but both these bodies, in common with other Port Authorities, would be entitled to make direct representations to the Authority on matters affecting their ports.

It is suggested that the Leith Dock Commission, London Midland & Scottish and London & North Eastern Railway Companies should each appoint one member to the Authority. In order that the Authority may not be over-weighted in respect of any particular interest, it is considered that the members nominated by the Port Authorities should not be either shipowners or pilots, but this restriction is suggested by way of advice to the Port Authorities and should not be imposed by regulation in the Order.

The three shipowners appointed to the Forth Authority are nominated by the Leith Shipowners' Society and it is provided that one of the representatives should be a Grangemouth ship owner. Complaints have been made by shipowners and ship brokers at some of the ports that under existing arrangements they are not adequately represented on the Authority and in particular the Grangemouth, Bo'ness and Alloa Shipbrokers and Shipping Agents Association have asked for a revision of the present practice. It is suggested that the shipowners should appoint three members to the new Authority but it is desirable that the members should be as far as possible representative of the Forth Area as a whole and not be nominated by the local society of one port, even though that is by far the largest port in the district. It is proposed, therefore, that until such time as an association of shipowners has been formed to cover all the ports of the Forth Area the right of nomination should be entrusted to the Chamber of Shipping of the United Kingdom, who would doubtless have regard to the views of the various local shipping organisations.

It is suggested that the pilots should appoint three members to the new Authority, with three other pilots to act as substitutes. The members should be elected in a similar manner to that provided under the present Order of the Forth Authority. The fear was expressed by one of the port representatives that the pilot members of the new Authority might all be from one port, as apparently is the position with the existing Forth Authority and the suggestion was made that the pilot-members should be elected in such manner as to provide a representative for each port or group of ports. Sir Robert Letch said he cannot support this idea, for the reason that it would tend to perpetuate sectional interests. The pilots must be left free to elect their own representatives, but it is hoped that the pilot-members will realise that their duty will be to promote the general interest of the whole body of pilots and thus assist to unify the service.

The shipowners have suggested that they should have a similar privilege to that granted to the pilots under the present Forth Authority (and proposed to be continued in the new Authority) and be permitted to nominate substitutes for any of the three shipowner-members appointed by them. The practice of allowing the pilot representatives to have substitutes is well-established and arises from the fact that the pilots are engaged on a service involving duty at any hour day or night, which may prevent them attending meetings of the Authority. There would no doubt be some slight advantage in giving the shipowners the right to appoint substitutes, but Sir Robert felt that this would be far outweighed by the obvious disadvantages and, in the circumstances, did not recommend the proposal.

Compulsory or Non-Compulsory Pilotage

Pilotage in the Forth has always been on a non-compulsory basis, except during the two recent wars when it was made compulsory under Admiralty orders. The pilots' representatives at the Conference strongly urged that in future pilotage should be compulsory. They contended that as the service must be maintained at all times, whether or not the master of a particular vessel chooses to take a pilot, all ships using the port should make a contribution to the fund, thus spreading the financial burden over a greater number of shipowners, all of whom have the right to call upon the service at a moment's notice. The shipowners objected to the proposal.

Under existing legislation the only ground upon which a proposal for compulsory pilotage could succeed is that navigation in the particular district is so difficult that compulsory pilotage is necessary for the safety of the vessels.

The problem has already been considered on two occasions, viz., by the Commissioners of Pilotage in 1914 and by the Board of Trade Inquiry in 1921. Both these bodies decided against compulsory pilotage in the Forth Area and nothing has happened since that time to increase the difficulties of navigation in the district. On the contrary, the various scientific and other aids which have been developed during the past few years have facilitated navigation and the case for compulsory pilotage is now even weaker than it was at the time of the previous inquiries.

It has been suggested in some quarters that a case for compulsory pilotage might also be made in the event of the earnings of pilots under a non-compulsory system being insufficient to attract competent officers to undertake the duties. On this point it is only necessary to say that an efficient pilotage service has been provided in the Forth for many years on a non-compulsory basis, and that, providing the work is reorganised on the lines discussed at the Conference and outlined in this Report, it is reasonable to anticipate that an adequate service could be maintained in the future, and a fair remuneration secured for the pilots.

It is, therefore, considered that pilotage in the Forth Area should remain on a non-compulsory basis and provision made accordingly in the new Order.

Limits of District

It is suggested that on the basis of non-compulsory pilotage the seaward limit of the new Authority should be a line drawn north and south through Fidra which is about 5 miles westward of the seaward limit of the present Forth Authority. In practice the

Pilotage in the Firth and River of Forth—continued

pilot boat for the easternmost station is located at Fidra and there is no advantage in extending the district beyond this point. The landward limit should be the same as for the present Authority.

The Conference considered the question of excluding the commercial docks, etc., from the Pilotage District (as is the case in certain other districts such as London and Liverpool). There are, however, practical advantages in continuing the present system of including the docks as in the Forth Area, dock pilotage involves not only the movement of the vessel between the dock entrance and the berth but also between the entrance and the adjoining roadstead. It is suggested, therefore, that the district should include all the harbours, basins, docks, piers, wharves, etc., within the area at which vessels may be accommodated, with the exception of the Admiralty Dockyard, which must continue to be excluded from the Pilotage District.

If it were ever decided in the future to introduce compulsory pilotage the seaward limit of the district should be Inchkeith.

Pilotage Rates

The new Authority should review the existing rates structure both for pilotage in the Firth and river and also in the docks and prepare a comprehensive schedule based, as far as possible, on similar principles of charging in like circumstances. The rates should be based, in all cases, on gross registered tonnage or on a combination of draught of vessel and gross registered tonnage.

In reviewing the rates the Authority should give sympathetic consideration to the position of Grangemouth and Bo'ness arising out of the proposal to abandon the Forth Bridge Station, with a view to ensuring that the charges for the additional distance to be piloted do not impose a undue burden upon vessels using those ports.

Boarding and Landing Rates

The present rates for boarding and landing are seriously unremunerative and involve the Forth Authority (or in some cases the pilots) in heavy loss. Proposals to increase the rates of the objection to the increase was made by one section of pilots. The matter was discussed at the Conference and it was recommended that the proposals as submitted by the Forth Authority be approved. The question of increasing the rates at the local ports is under discussion between the shipowners, pilots and other interests, and it is hoped that agreed proposals will shortly be submitted to the Minister. Pending the receipt of the proposals, it is suggested that the Minister should take no action on the representations already made to him regarding the rates at Burntisland.

Summary of Recommendations

The following is a summary of the principal recommendations and suggestions in the report:—

1. A new Pilotage Authority to be created to supersede the six existing Authorities.
2. The constitution, powers and duties of the Authority to be divised within the provisions of the Pilotage Act, 1913.
3. The title of the Authority to be the "Forth Pilotage Authority."
4. The Trinity House of Leith; Forth Conservancy Board; Town Council of Kirkcaldy and Granton Harbour, Limited, not to be represented on the Authority.
5. The Leith Dock Commission; London Midland and Scottish Railway Company and the London and North Eastern Railway Company each to appoint one member to the Authority.
6. The shipowners to appoint three members. The members to be nominated by the Chamber of Shipping of the United Kingdom until such time as an association of shipowners has been formed to cover all ports of the Forth Area.
7. The pilots to elect three members (with three substitutes) in a similar manner to that for the existing Authority.
8. The Authority to be constituted of 10 members as follows: Admiralty 1, Port Authorities 3 (one each for Leith Dock Commission, L.M.S. Railway Co., and L. & N.E. Railway Co.), Shipowners 3, and Pilots 3 (with three substitutes).
9. The Chairman to be elected by the Members from within their own number.

   The Chairman and Members not to be paid for their services.

   The term of office to be three years.
10. Certain whole-time officers and servants of the present Forth Authority to be suitably protected on transfer.
11. Pilotage to continue on a non-compulsory basis.
12. The seaward limit of the district to be at Fidra and the landward limit to be the same as for the present Authority. All docks, etc. (other than the Admiralty Dockyard) to be included in the district.
13. In the event of pilotage ever being made compulsory, the seaward limit of the District to be restricted to Inchkeith.
14. Pending the creation of the Authority, the existing Authorities not to grant any new licences.
15. Pilots, subject to present needs, to be encouraged to take suitable alternative employment as a temporary measure.
16. The Authority not to make a charge for the annual renewal of pilot licences.
17. The retirement age for new pilots to be 65 years.
18. Pending the creation of the Authority, the present Authority and the pilots to agree to the pilots of Bo'ness, Grangemouth and Burntisland sharing in the Inward Firth Pilotage.
19. The Forth Bridge Station to be abandoned.
20. Wireless telephonic communication to be established between the pilotage headquarters; pilot stations and incoming vessels. Thereafter one pilot station only (at Inchkeith) to be maintained.
21. The Authority to take over the dock pilot boats.
22. Choice pilotage to be permitted on specified conditions.
23. Masters' and mates' certificates to be granted on payment of annual fees, subject to payment of shipowners in respect of certain vessels.
24. The Authority to review the pilotage rates for the River, Firth and Docks and prepare a new schedule.
25. The proposals of the present Forth Authority to increase their boarding and landing rates to be approved. The boarding and landing rates of the local Authorities to be reviewed and proposals for revision submitted to the Minister.
26. The Authority to be responsible for the collection of all pilotage dues, boarding and landing fees, etc., and for the disbursement to pilots.
27. The claims of ex-pilots (or their widows or dependants) on the existing benefit fund to be settled and a benefit scheme for all serving pilots to be devised.

Re-organisation Committee

The members of the Conference appreciated that any proposals which might be made could only be in broad outline, and that there would be a large amount of detailed work to be done in preparing the necessary draft Order and Code of Bye-laws. It was, therefore, agreed that a Re-organisation Committee should be constituted with the following powers:—

1. The Members to be free to discuss all proposals with their constituents or associates and to be entitled to bring to the committee expert advisers.

2. The Committee to draft the Order and code of Bye-laws to give effect to the principles discussed at the Conference and outlined in this Report. The Committee should avail themselves of the experience of Pilotage Authorities elsewhere in the United Kingdom as well as that of the three national organisations represented at the Conference, and embody in the new code of Bye-laws the best practice of other ports.

3. The Committee, in conjunction with the existing Pilotage Authorities, to consult actuaries with a view to formulating a Pilots' Benefit Scheme for submission, through Mr. Meikle (Area Secretary Transport and General Workers' Union) to the general body of pilots.

4. The Committee to discuss their proposals for the Order and Bye-laws with the existing Pilotage Authorities. It will be the duty of these Authorities to submit the agreed draft Order and Bye-laws to the Minister, and it is important that every endeavour should be made to get unanimity amongst the Pilotage Authorities, shipowners and pilots in the hope that the proposals may meet with no opposition when advertised in accordance with the provisions of the Pilotage Act, 1913.

Port Operation

Part 2 (B) of a series of articles by A. H. J. BOWN, M.Inst.T., A.C.I.S.
and Lt.-Col. C. A. DOVE, M.B.E., M.Inst.T.

Organisation *(continued)*

Outboard

THE term outboard covers a multitude of activities, and for the purpose of our examination, includes all the many operations performed within the port area either by land or water beyond the ship's rail, e.g., piloting, dredging, lighting, buoying, locking ships in and out, dry docking, landing and delivering cargo, receiving and loading cargo, providing and maintaining cranes, runabouts and hoists, policing, providing power, bunkering, watering, lightering, towing, and examining by H.M. Customs.

As has already been emphasised these operations may be the responsibility of many or few organisations, but the Port Undertaking, even where its responsibilities are limited, is certain, by virtue of its statutory status, to exercise a considerable influence and often control over the other operators.

The number and the titles of the departments into which a statutory port undertaking's organisation may be divided differs as between ports but broadly speaking, depending upon the powers conferred under its Act, one may expect to find the following:—General Manager's; Traffic; Engineer's; Secretary's; Solicitor's; Accountant's; Treasurer's; Conservancy and Harbour Master's; Police, Staff; Estate; Public Relations. The examples set out below are fairly typical. The names of the departments are in most cases a guide as to their activities. All of them have an important bearing on port operation but some, such as the Solicitor's, Secretary's and Accountant's can be more appropriately dealt with under Port Economics and for that reason will not be considered separately here.

BRISTOL

General Manager and Collector of Dues

Chief Engineer	Secretary	Accountant	Haven Master	Assistant General Manager
			Responsible for Conservancy and Surveying of the waterways of the Port and responsible to Pilotage Committee of the City Council for pilotage matters	

Assistant General Manager

Docks Superintendent (Avonmouth and Portishead Docks)	Traffic Manager (City Docks)	Dock and Harbour Master (City Docks)	Stores Superintendent	General Manager's Department	Superintendent of Police
	Responsible for allocation of berths and storage of goods in sheds and warehouses	Responsible for docking and berthing of vessels	Responsible for purchase and issue of all stores	See below	Responsible for policing of Docks Estate

LEITH DOCK COMMISSION

General Manager and Secretary

Chief Asst. Engineer	Asst. Gen. Manager	Treasurer and Collector	Law Agent and Asst. Secretary
Dockmaster	Traffic Asst.	Grain Warehouse Manager	

BRISTOL

General Manager's Department

Traffic Agent	Head Clerk		Establishment Officer
Responsible for publicity, negotiations for new trades, etc.	Claims, General matters, Compilation of rates for dues, labourage and other operations, and matters of policy	Trade Statistics	Responsible for staff matters, monthly and weekly staffs

COMMISSIONERS FOR THE PORT OF RANGOON

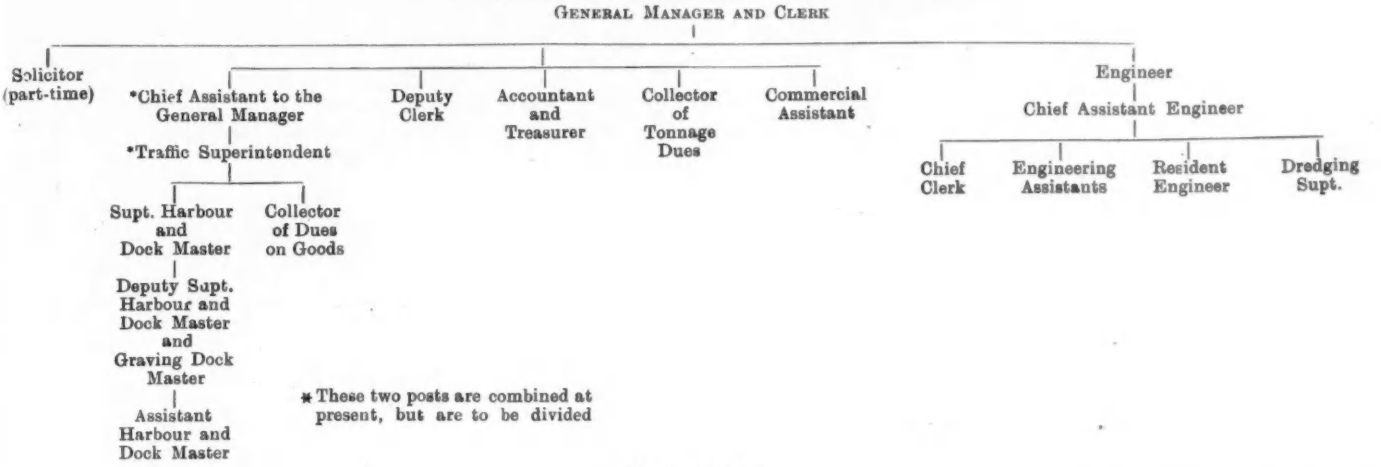
Chairman (and Chief Executive Officer)

Deputy Chairman, Financial Adviser and Co-ordination

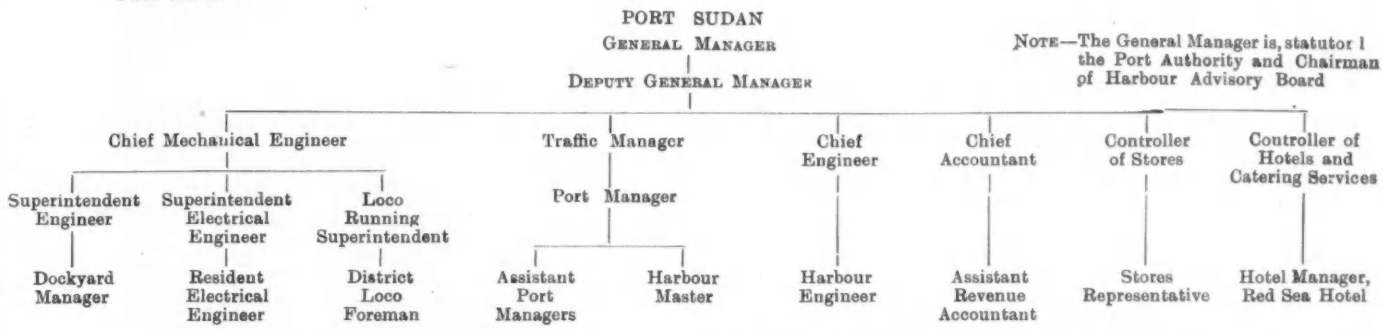
Chief Accountant	Chief Engineer	Chief Mechl. Engineer	Marine Superintendent	Medical Officer	Secretary	Stores Officer	Traffic Manager
Deputy Chairman Financial Adviser Accounts Mechanized Accounting Receipt and Payments Establishment Wages Provident Fund Loans Management Rates, Dues and Charges	Regime of River and Harbour, including River Training Maintenance Repair & renewals (except Marine Plant and Dock Handling Gear) New Construction Land Surveys	Maintenance, Repair & renewal of Mechanical and Electrical Plant, Dock Handling Gear and Flotilla Electric Supply Chain Testing and Annealing	Marine Craft and Plant (except Engineering Construction & Wharf Dredging Plant) Pilotage & Berthing of Ships River Surveys Aids to Navigation Moorings Salvage Fire Fighting (Afloat) Channel Dredging Berthing of Ships in Stream Control of Flotilla Registration of River Craft and Crews	Public Health M.I. Rooms Dispensaries Port Sanitation	Secretary to Board Indoor Assistant to Chairman Legal matters Office Management Time Study Central Records Central Despatch Central Typing Central Library Returns & Statistics Welfare (except Labour) Office & Residential Accommodation and Furniture Bye-Laws, Rules and Orders	Purchase, Custody and Issue of Stores Stores Accounting Standards Committee	Docks Foreshores Warehouses Godowns Labour and Labour Welfare Estate Management Berth Allocation Fire Fighting (Ashore)

Port Operation—continued

RIVER WEAR COMMISSIONERS (SUNDERLAND)



PORT SUDAN



General Manager's Department

It is not proposed to go into the General Manager's functions or his department in detail. Briefly, it is his responsibility to implement the policy of the Board by means of instructions, issued by him to his departmental heads which, when acted upon, will ensure that both the letter and spirit of the orders of the Board are fulfilled.

In addition to what may be termed these " managerial " duties many General Managers assume direct responsibility for other departmental functions, e.g., Secretary's, Engineer's and Traffic. Sometimes this dual capacity is revealed in his title, e.g., General Manager and Secretary, Mersey Docks and Harbour Board, General Manager and Clerk, River Wear Commissioners (Sunderland); General Manager and Collector of Dues, Bristol; General Manager and Engineer, Granton. Such arrangements, however, are frequently, although not always, peculiar to the person holding the office of General Manager either because of some professional qualifications he holds, e.g., engineering or of some wide experience he may have gained in a particular department of a port undertaking. The Secretary's title is often borne by the General Manager in order to enable him to discharge certain statutory duties laid on the Secretary by the creating act, in this capacity he is known as a " statutory officer " or " official."

Traffic Department

The Traffic Department or its equivalent in a port undertaking is the department mainly engaged in Port Operating. Sometimes, as at London and Leith, it is part of the General Manager's Department but more usually, as at Liverpool and Calcutta, it operates as a separate department under an officer known as the Traffic Manager who is responsible to the General Manager for its efficient operation. The duties of the Traffic Manager, as will be shown later, depend on (1) the powers vested in the port undertaking by its Act and (2) the division of duties as between departments favoured by the management.

Whatever his powers and duties the Traffic Manager's Department extends throughout the whole area controlled by the port undertaking wherever cargo is being handled or passengers embarked or disembarked. The internal management and administration of the department, and its contact with the users of the port and the other departments of the undertaking, are usually centred in a Traffic Department headquarters organisation which operates from the Head Office of the undertaking, or wherever else the Traffic Manager's personal office is situated. In ports of any size those parts of the Traffic Department which are located outside the headquarters section are decentralised by dividing the port into a number of geographical areas, each of which corresponds to a dock or series of docks or quays capable of being administered as self-contained units.

Headquarter's Section

In most ports the headquarters organisation of the Traffic Department is sectionalised to functions and not to areas. It is difficult to generalise, but the following division into sections may be taken as fairly representative of most ports, (1) Commercial, (2) Docks, Quay and Warehouse, (3) Railway, (4) Shipping, (5) Dockmasters. To manage these sections and the functions they control throughout the port, the Traffic Manager has two or more Assistants. The number of Assistants and the method of apportioning these sections to them varies from port to port.

Almost invariably the Commercial Section is made the sole responsibility of one Assistant known as the Commercial Assistant or Superintendent. It should be noted that in some ports the Commercial Section functions as a separate department under its own head, who is answerable direct to the General Manager and not to the Traffic Manager. In such ports the officer responsible for the balance of the Traffic duties described above would probably be styled the Docks Manager or Operating Manager and not the Traffic Manager.

The allocation of the other sections, i.e., docks, quay and warehouse, railway, shipping and dockmasters, varies considerably. In some ports they are all placed under one assistant known as the Operating Assistant. In others, Calcutta for example, docks, quays, and warehouses and some of the shipping responsibilities, are placed under an assistant known as the Docks Manager, the docks railway under another assistant called the Railway Operating Superintendent, and the Dockmaster's Section and the balance of

Port Operation—continued

the shipping responsibilities are taken out of the Traffic Manager's control altogether and placed under the Harbour Master. It is interesting to comment here, however, that in Glasgow the responsibilities of the Traffic Manager of the Clyde Navigation Trust are at present placed under an officer known as the "Harbour Master and Traffic Superintendent," who is not only a traffic man but also technically qualified to fulfil the professional responsibilities of a Harbour and Dock Master.

Commercial Section

The Commercial Section is responsible for (1) assessing rates, dues and charges, (2) interpreting and advising on the application of rates, dues and charges (in some ports the responsibilities set out in 1 and 2 are not dealt with by the Traffic Manager's Organisation, e.g., Bristol, where they come under the General Manager), (3) co-operating with traders and shipowners, (4) Customs, (5) watching trade tendencies, (6) endeavouring to attract traffic to the port, both at home and abroad.

All matters relating to rates, dues and charges are normally dealt with by a team of specialists under an officer known as the Rates or Charges Officer or Clerk.

The contact with the users of the port is made by selected officials of the Commercial Section who are deputed to deal with trades and industries in which they have specialised and for which they have been trained. Some of the larger ports employ representatives overseas and in the important industrial areas in this country, whose business it is to advise on such matters as port facilities, charges and Customs procedure to those using or considering using the port.

Of late years the documentation attendant upon Customs procedure has become increasingly a specialist's job. In order to assist the users of the port in this direction, it is customary for port authorities in this country to set up a special section to prepare Customs documents for traders or advise them on procedure. Most traders, however, avail themselves of the services of Shipping and Forwarding Agents for this purpose.

Operating Section

The range of duties of the operating section depends very much on the responsibilities assumed by the port undertaking under its Act. In a port possessing very wide powers one would expect to find the following outboard functions included: docking and undocking ships; locking and unlocking ships; dry docking ships; receiving cargo from or delivering cargo to hook; conveying cargo to or from transit shed or warehouse; housing or unhousing cargo; delivering cargo to or receiving cargo from land or water conveyance; striking cargo for export, i.e., discharging cargo from conveyance to stack awaiting export; warehousing; examining for external damage; opening for H.M. Customs; sorting; weighing; measuring; piling, i.e., stacking cargo; unpiling; marking; gauging, i.e., measuring the content of liquid containers such as barrels and casks; coopering, i.e., repairing or remaking damaged tubs, casks, barrels, and similar containers; taring; sampling; labelling; embarking and disembarking passengers. In addition to such outboard duties, some port authorities also undertake the inboard duties, already described, for shipping companies and when this happens these responsibilities are discharged by the Traffic Department.

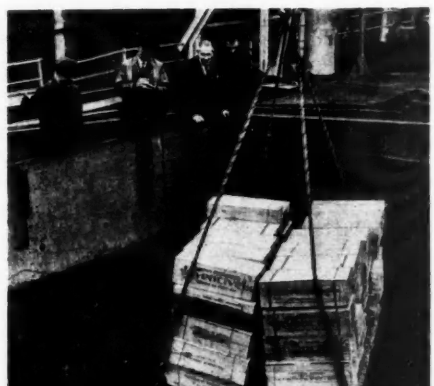
Operating Section Headquarters

In the operating section at headquarters, depending on the size of the undertaking and the preference of the Traffic Manager or his Assistant, separate officers would probably be detailed to deal with the work on the following lines: (1) shipping matters, including berthing and dry docking arrangements, (2) labour matters, including fixing piece-work rates, or confirming them where they have been negotiated by the undertaking's representatives at the docks, (3) floating plant, mechanical appliances, crane hire and lighting, (4) cargo handling gear, (5) internal transport and communications, (6) warehousing, (7) towage, lighterage, cartage and hire of craft, (8) claims in respect of such matters as loss or damage to cargo, damage to ships, lost journeys and injuries to personnel, as well as claims for loss or damage sustained by the undertaking, (9) application of bye-laws and regulations.

The berthing of ships is of sufficient importance to merit special mention. It is usually delegated to a very senior official known as a Berthing or Shipping Superintendent or perhaps Chief Dock Master. The word "stemming" is the one used in shipping circles to describe the arrangements necessary to berth a ship. Stemming entails close co-operation on the Berthing Superintendent's part with the ship owners, agents or brokers, the pilot service, the harbour master's service, the dock master's department, and the port undertaking's senior executive in the dock (Dock Superintendent) in which the ship is to be berthed.

Some shipping companies always use the same berths under arrangements made with the port undertaking, such berths are known as appropriated berths. Other companies apply for berths for their ships as and when they are due.

In the former case it is only necessary for the Berthing Superintendent to settle a time for berthing, but in the latter case he has to arrange, in addition, for a suitable berth.



Set of sardines being hoisted from square of hatch, lower hold. Showing 2 stevedores (others standing back), hatchwayman (left) and checker (right with cap)

In both cases he keeps himself up-to-date with the movements of expected ships through the various daily shipping papers or journals which are published and by contact with the ship owners, agents or brokers, who are frequently in wireless communication with their ships. He calculates the arrival time in dock on information supplied by the Pilotage Authorities and the Harbour Master's Service, after consulting with the Dockmaster and the Dock Superintendent as to the berth or dry dock and the time of its availability. The operation works in reverse for ships leaving the port.

It is apparent that the Berthing Superintendent requires not only to know the lengths of his berths but also working depths and to possess up-to-date information on repairs and new works under construction at berths. Good berthing also pre-supposes an accurate knowledge of the particular characteristics of each berth, although in actual practice few berthings are made without reference to the Dock Superintendent who should be an expert in such local matters.

In those ports where the Dockmasters Section is a part of the Traffic Department, the Operating Assistant would probably have a senior Dockmaster on his staff.

Although the division of cargo handling into inboard (ship) and outboard (shore and overside) is clearly made at ship's rail, the

Port Operation—continued

division of responsibility for the physical performance of these operations as between the " ship " and the port undertaking varies in an almost bewildering manner from port to port. The Operating Section of the Traffic side is the department of the port undertaking most affected by these differences in practice, examples of which are quoted.

The Great Western Railway Company in their South Wales ports are willing and organised to do all ship and shore work. The Manchester Ship Canal Company go a step further and will allow nobody else to do it but themselves. The Port of London Authority will undertake both but only at certain places. Leith Commissioners and the Clyde Navigation Trust (Glasgow) do neither themselves. The River Wear Commissioners (Sunderland) undertake to do both but let all stevedoring out to contract. The Calcutta Port Commission does not undertake any inboard work at all but carries out all the shore work, although at some quays labour contractors are employed by the Commission. Mersey Docks and Harbour Board (Liverpool) undertake to carry out specialised work only with their own labour, all the rest, both ship and shore, is performed by private undertakings, although it should be noted that the Harbour Board exercises strict control through its bye-laws over such private operators. An interesting difference even between import and export practice is to be found in Alexandria, where in peace-time it is customary (dependent upon the terms of the Bill of Lading) for the " ship " (owner or agent), in the case of imports to handle the whole cargo from the hold to the stack on the quay, but in the case of exports, for each shipper (of whom there are some twenty-two operating in Alexandria), to exercise his right to handle his own export cargo under his own arrangements to derrick or crane hook, at which point the " ship " takes over.

Docks

The senior representative of the Traffic Manager in each of the geographical units or divisions into which the port is divided is called the Dock Superintendent. He is responsible to the Traffic Manager for the efficient performance of the functions ascribed to the Traffic Manager and for co-operating with the other departments in the dock not controlled by the Traffic Manager, e.g., Engineer's, Police and Railway (in cases where it is administered by a separate officer). In addition he acts as the port undertaking's senior executive in their dealings with shipowners, traders, Customs, lighterage firms and other operators in the dock, and with local authorities in connection with purely local matters.

Dock Operating is an extremely practical business and in the interests of efficiency it is necessary to make many decisions on the spot. It is obvious, however, that policy decisions are outside the terms of a Dock Superintendent's powers and one of his most important duties is to decide when to submit to higher authority and when to act. Such a situation demands not only sound judgment on the Dock Superintendent's part, but also first class briefing by the Traffic Manager by means of working instructions and orders.

The Dock Superintendent is generally aided by Assistant Dock Superintendents, the number of whom depends upon the size of the area he administers. In some ports the work is shared on a geographical basis and each assistant is given an area to cover. In others, the work is divided on a functional basis, a favourite division being into " outdoor " and " indoor," where the " outdoor " assistant deals with all practical dock operating matters and the " indoor " assistant confines himself to administration and documentation.

Situated in the same building as himself the Dock Superintendent has his own headquarter's staff which is functionalised on parellel lines with the Traffic Manager's headquarters.

The Dock Superintendent's area is further divided into sections called departments, each of which is controlled by an official known by various names, e.g., Quay Superintendent, Wharf Superintendent, Inspector, Warehouse-keeper and Traffic Officer. A department may be composed of a number of berths and transit sheds, or, where the port undertaking is also a warehousing authority, it may be a warehouse or cold store or a series of such buildings. There can be no universal rule and local conditions usually determine what comprises a department.

Each department has its own departmental office from which it is administered and controlled. This office is responsible for much of the documentation connected with dock operating, including the preparation of out-turn reports, weight accounts, landing accounts, the recording of operations performed on behalf of users of the port and accident reports. It also deals with such matters as the centralising of orders for craft and other forms of transport, the circulation of instructions, arranging for the maintenance and renewal of cargo handling gear, fire fighting appliances, cluster lights and, where they are a traffic responsibility, runabouts, mobile cranes, fork lift trucks and other similar appliances. Another important function is the payment of dock labourers and other employees. This is usually dealt with by one of the Quay Superintendent's assistants known as a Cashier or Pay Clerk, who is responsible not only for the actual payment of wages earned, but also for the collection and compilation of the records from which they are calculated. Since the advent of the National Dock Labour Corporation and kindred organisations, the duties detailed above, as far as dock labour is concerned, have passed, in this country, to these organisations, as will be explained later. Employees not coming under their control, however, are still paid by the Quay Superintendent's Pay Clerk.

Depending upon the size of the department each Quay Superintendent is in turn supported by one or more assistants. Where there is more than one, each assistant probably controls two or three quays but all of them operate from the departmental office and work under the direct control of the Quay Superintendent. Every quay is usually equipped with its own office known as a quay office which is used as a base by the shed or quay staff. Such offices, which are frequently portable, are little more than boxes and are invariably situated inside or adjacent to the transit shed on the quay. In some ports they are built above the lock-up cage in the transit shed which is used for the housing of valuable or highly attractive cargo awaiting disposal or shipment.

These Assistant Quay Superintendents are the senior representatives of the port undertaking in continuous direct contact with the work. Their responsibilities are practically dictated by the powers exercised by the port undertaking in the area which they control, for it is obvious that if their area included some appropriated berths, or berths at which the " ship " undertook all work from hold to stack, then their duties would not only be different in character but less in number than if the port undertaking were the sole operator. For the purpose of dealing with quay organisation as comprehensively as possible, the duties of these officers and their subordinates will be dealt with as if the port undertaking were fully responsible for all the shore operations between hook and conveyance.

The responsibilities of these officers would include: (1) supervising the work of the quay staff, (2) providing advance information to quay staffs of (a) ships arrivals, (b) cargoes expected; in the case of imports this would include supplying them with the following documents: ship's manifest, stowage plan and disposal instructions (where known); in the case of exports, the documents would include engagement list (a document prepared by the shipping company listing in detail the cargo to be shipped and all relevant information required for stowage purposes, such as descriptions, weights, measurements and any special stowage instructions, e.g., " deck cargo," and " to be stowed away from boilers ") and pre-stowage plan (where prepared). (A pre-stowage plan is a tentative stowage plan prepared by the shipping company's shore staff, when a full cargo has been booked prior to the ship's arrival. It is made out before the ship arrives largely for the purpose of assisting the quay staff to stack the export cargo in the transit shed in the most convenient places for loading. Such plans are always subject to amendment by the master, who it must be remembered is responsible for the safety of the cargo and the trim and stability of his ship when loaded. It is not intended that the pre-stowage plan should replace the " as stowed " plan, which is prepared as the ship loads in the usual way), (3) employing labourers, checkers, tally clerks and other employees, (4) paying of employees, including negotiation of piece-work rates, (5) order-

Port Operation—continued

ing and placing of cranes and lighting, (6) providing mobile cranes, runabouts and other similar appliances, (7) hire of floating cranes, where these are supplied by the port undertaking, (8) co-ordination of ship, shore and overside working, (9) expeditious clearance of cargo through H.M. Customs and from transit sheds, (10) correct stacking of cargo, (11) ensuring that shunting may be punctually executed, (12) ensuring that all operations performed on behalf of the ship and the trader are accurately recorded for purposes of collecting the port undertaking's revenue.

At the back of the minds of the Assistant Quay Superintendent and his staff, even when their responsibilities are limited to outboard work only, there should always be present the necessity for rapid ship turn-round, for the acid tests of good dock operating in order of importance are, (1) expeditious ship turn-round, (2) efficient clearance of cargo in good condition from the dock transit area.

To assist him in the discharge of his wide range of responsibilities the Assistant Quay Superintendent has a staff of foremen, among whom the work is divided either on a geographical or a functional basis according to the duties involved.

In many ports it is the practice to employ the same staff as regularly as possible at the same quays, for by so doing it has been found that local advantages and knowledge can be turned to account and difficulties attendant on local circumstances are more easily overcome or minimised.

It is customary to have a Quay Foreman, Shed Foreman or Shed Master in charge of each ship's berth and its transit shed. It is his duty (1) to make certain that he is in possession of all available advance information from the Assistant Quay Superintendent and to disseminate it amongst his own staff, (2) clear the berth ready for the ship to tie up, (3) have cranes and lighting in position, (4) have all the cargo handling gear required ready for use, (5) order mobile cranes, fork lift trucks and other similar appliances, (6) estimate and order daily the number of labourers, checkers, coopers, crane drivers, capstanmen, weighers, measurers, sewers (needlemen or stitchers) and any other operatives he may require for the following day's work, (7) supervise the work of all employees taken on, (8) keep railway lines clear of cargo so that shunts can take place punctually and with a minimum of lost time, (9) allocate space in the shed for the stacking of cargo prior to examination and delivery, (10) satisfy himself that the most suitable cargo handling gear is being used (in the case of the ship he would do this in co-operation with the Ship's Foreman), (11) satisfy himself that the sets or drafts of cargo are as near in weight to the capacity of the lifting power of the ship's derricks or quay cranes as the nature of the cargo and other conditions will allow, (12) order lights for night working when required, (13) arrange for quays and sheds to be cleaned after each ship has completed, (14) arrange for completed tally cards to be collected at intervals from checkers and tally clerks, (15) keep a daily summary showing for each ship (a) manifested cargo, (b) cargo still in the ship to holds, (c) cargo discharged each day from each hold to (i) shore, (ii) overside, (d) cargo still in shed, (e) cargo delivered direct by (i) road, (ii) rail, (iii) water conveyance.

The delivery of cargo from transit sheds is supervised by foremen known as Delivery Foremen. A Delivery Foreman is responsible for (1) supervising work of delivery gangs, (2) ensuring that cargoes are only delivered against production of documents which have been passed by the port undertaking as being in order (it is not his responsibility to scrutinise or decide the validity of the documents of title—this is usually done by a Cargo Ledger Clerk as will be explained later), (3) ensuring that cargo is not delivered until it has been cleared of Customs, i.e., that correct Customs documents have been produced, that H.M. Customs have completed their examination, and where duty is payable, that it has been paid or arrangements have been made to store the goods in bonded warehouse, (4) ensuring that stacks of cargo are efficiently " broken down " or " unpiled " or " unhoused " (this last term is normally only used of cargo in warehouse), (5) ensuring that cargo is properly stowed in the conveyances used to take it away, (6) organising the loading of road traffic, (7) estimating and ordering daily labourers, checkers, carpenters, for repairing damaged cases, coopers, stitchers (needlemen for repairing damaged bags and bales), mobile crane drivers and any other workpeople required for the following day's work, (8) ensuring that correct cargo handling gear is used, (9) indenting daily for the number of empty railway waggons required for the following day's deliveries by rail from the quay or shed, (10) ensuring that all work performed is recorded.

The control of cargo for export in most ports is the responsibility of the Export Foreman. His duties include (1) ensuring that he has all the available documents from the Assistant Quay Superintendent before the ship opens for export, (2) supervising the work of the striking gangs, (3) stacking cargo in the shed according to port of destination and stowage requirements of the ship and thereby minimising cross leads, i.e., labourers crossing one anothers paths as they carry from cargo stacks to the ship's side, unnecessary double handling of heavy lifts and other wasteful operations, (4) giving a receipt for cargo received for shipment, (5) ensuring efficient stacking, (6) calling down cargo in railway waggons from the marshalling yards, (7) arranging to port mark cargo where necessary, (8) satisfying himself that cargo is fit for shipment before it is placed to hook, (9) ensuring that Customs formalities have been complied with before shipment takes place, (10) recording operations, (11) estimating and ordering daily labourers, checkers, carpenters, sewers, weighers, measurers, painters to meet the following day's requirements, (12) ensuring that hazardous cargo is not called down until required, (13) ensuring that correct cargo handling gear is used, (14) arranging sheeting with tarpaulins and dunnaging where necessary, (15) arranging for the preparation of mates receipts for signature, (16) arranging for completed tally cards to be collected, (17) keeping a summary or exhaust showing (a) cargo on engagement list, (b) cargo in ship, (c) cargo still in shed, (d) cargo alongside in craft, (e) cargo on rail in the yards, (f) cargo due, by what means of conveyance and when.

In some organisations the Quay Foreman is the senior foreman and when exports are being worked he takes over from the Export Foreman at stack. In others the Quay Foreman has two assistants one of whom is responsible for all export operations from conveyance to stack and the other for all operations from stack to hook and for all cargoes loaded direct from conveyance to ship. In other ports there is no foreman called a Quay Foreman at export berths, but one foreman known as the Export Foreman who is responsible for all the duties already outlined. It is obvious that the names used are merely matters of local preference and custom. The important point for the student to keep in mind is that the functions which have been described are common to all ports.

Labour Foremen, one to each department, are usually made responsible for the employment or " taking on " of the labour. The general practice is for each type of foreman to place his estimate of labour requirements for the following day with the Assistant Quay Superintendent who after examining it and making such adjustments as he may consider necessary, passes it to the Labour Foreman for action. In most ports throughout the world it is customary for labourers to assemble, at certain points in the dock area known as " stands," at fixed times during the day, usually before the start in the morning and the start in the afternoon. The Labour Foreman attends and takes such men on as he requires and details them to their work. A good Assistant Quay Superintendent will make it his business to be in frequent attendance at this taking on of the labour.

Many port authorities, particularly those engaged in warehousing, undertake to draw samples of cargoes for merchants and traders. In many trades these samples are used for buying and selling and in consequence play an important part in market operations. The drawing of such samples requires considerable experience and knowledge, and the work is usually entrusted to employees of the port undertakings known as Foreman Samplers or their assistants.

In many ports a separate foreman known as a Crane Foreman is employed to supervise the placing of the cranes as ordered and the work of the crane drivers. In some ports he also controls the capstanmen. Sometimes he comes under the traffic side and sometimes under the engineering. When the latter is the case he is also usually made responsible for the maintenance of the cranes and the training and efficiency of the crane drivers, as is the case in the

Port Operation—continued

Port of Alexandria where the Ports and Lights Administration supply the cranes and the drivers. It is appropriate to mention here that the policy in regard to the provision of cranes and drivers differs considerably in different ports in this country. In London for example, the Port Authority provide quay cranes, but not necessarily crane drivers who may be employed direct by the hirers of the cranes. Yet in Liverpool where the port undertaking, unlike that in London, undertakes to do very little operating work themselves the Mersey Docks and Harbour Board not only provide the cranes but operate them with their own drivers.

There is considerable divergence of practice in the employment of capstanmen. In many ports they are regarded as specialists whose activities are limited to quay shunting by capstan, in some ports coming under the Dock Superintendent and in others under the Railway Superintendent. In other ports, such as Leith, they are supplied by the Railway Company which operates the docks railway on behalf of the port undertaking. At other places efforts have been made to train dock labourers to act as capstanmen as and when required.

The actual physical work of labouring on the landward side of the ship is carried out by dock labourers who are employed in teams known as shore gangs. In each gang there is generally a leading hand who in this country may be called a ganger, in Egypt a rais, or in India a sirdar. The number of men employed in each gang depends upon the operation being performed, the type of cargo being worked, the custom of the port, and the country in which the port is situated. For example, gangs tend to be larger when a good run (large consignment) of a homogeneous and easily-handled character is being worked, e.g., bagged cargo or small cases of provisions, than when small parcels of an awkward character are being handled, e.g., bridge parts or motor cars. It is usual to find that gangs are much larger in hot countries owing to the climatic conditions and the relatively low pay of the labourers. The descriptions given to the labourers depends on the type of work on which they are engaged. It is customary to call labourers employed on general cargo work, dockers, men working on grain, grain porters, those engaged on timber, timber porters. Those employed on handling coal in wagons for export are known in some ports as teemers.

Shore gang and truckmen receiving direct to 4 wheeled trucks. Checker in background

Each gang has a checker working with it. It is his job to take particulars of the number of packages handled and in some cases to record details of the marks and numbers of each package.

When goods are weighed on landing or delivery the work of weighing is carried out by weighers. In many ports where beam scales are in use, two men are required for this operation, one of whom adjusts the weights and the other balances the package or packages to be weighed. It should be noted that it is customary in some ports and in some trades for these weights to be accepted as a basis for all commercial transactions.

The dimensional measurement of cargo at the quay side or in the transit shed is a normal part of export practice in this and other countries throughout the world. The allocation of responsibility for this operation varies. In many ports in this country these measurements are taken by the shipping companies' own measurers whose figures are accepted in cases of dispute. In Leith, however, the Port Commissioners undertake this work and employ "meters" for the purpose. In Calcutta, an independent body of "licensed measurers" carry out this function when called upon to do so by any of the interested parties, i.e., ship, shipper or Port Commission.

Two important permanent employees who have not yet been mentioned are the tackleman and the shed man.

The tackleman, who is usually a stevedore or dock labourer of long experience, is responsible for issuing, storing and maintaining cargo handling gear. He is required to keep records chronicling

Weighing chests of tea, showing two weighers, 2 truckmen (one waiting for chest on scales) and checker or clerk recording weights

the issue and return of gear and when it is due for testing and annealing, i.e., re-tempering, to minimise the risk of accidents due to cargo handling gear breaking whilst in use.

A shed man may be described as the caretaker of the transit shed. He is responsible for keeping it locked when it is not in use, keeping it clean and watching over its fittings and furniture.

In addition to the above-mentioned staff and operatives who are generally regarded as "outdoor" personnel, the Dock Superintendent has on his establishment a staff of "indoor" clerks. The duties of these clerks will be dealt with later under office routine. At this stage it is sufficient to say that their main responsibilities include the recording of ships cargoes, recording and checking the validity of documents of title, recording transfers of ownership, preparing Dock Warrants and preparing accounts for dues and charges incurred by users of the port. Normally they are housed in a separate office and operate quite independently of departmental control, coming directly under the Dock Superintendent or one of his assistants. Although these clerks are members of the Traffic Department, the Accountant's Department has certain responsibilities in relation to their work which will be explained later.

Where Traffic Departments also cover ship work, a similar set-up to the one already outlined under "inboard" is dovetailed into the Dock Superintendent's organisation.*

(To be continued)

ADDITIONAL READING

Chapters III and IV—Port Administration and Operation by Brysson Cunningham.

Chapters I and III—Port Economics by Brysson Cunningham.

Chapter III—Port Development by MacElwee.

Chapter II—Modern Dock Operation by D. Ross Johnson.

The 3 illustrations are reproduced by courtesy of the "P.L.A. Monthly."

Recent Protection Works carried out on the Sea Wall, Bray, Co. Wicklow.

By H. A. DELAP, B.A., B.A.I., Assoc.M.Inst.C.E.

(Concluded from page 255)

Discussion

Mr. E. M. Murphy, proposing a vote of thanks to Mr. Delap, said the work described in the Paper set a very good headline for engineers engaged in the carrying out of similar undertakings. This was the first time that coast protection work had been done by means of small, pre-cast units such as were used by the Board of Works.

The Speaker had taken a considerable interest in the work of protecting the sea wall and other works at Bray. Mr. Delap had referred to the history of the collapse of the sea wall. The cause of the falling of the beach at that place was undoubtedly the building of the harbour wall, and particularly the south pier of the harbour. That pier had acted as a high groyne and had caused scour, as well as being responsible for a stoppage in the passage of material.

Since 1934, until the wall ultimately collapsed, Mr. Murphy had noticed the seriousness of the position and reported on it many times. The beach was going down continuously; rising slightly at times and then falling again, but in the aggregate it was a continuous drop.

He had convinced the Urban District Council of Bray of the seriousness of the position, but at the time was not able sufficiently to convince the Government Departments concerned. Ultimately, when the breach actually did occur, the Government stepped in in an exceedingly generous and capable way.

Mr. Murphy was still of the opinion that the actual collapse could have been avoided by careful, low groyning, and he thought it would be well worth trying to build the beach up still with groyning of that description. He hoped to be able to put in a couple of experimental low groynes during the coming year with a view to keeping the beach up to where it was at the moment, which, as Mr. Delap indicated, was some six to eight feet below the level at which it stood when the wall was built and prior to the building of the south pier of the harbour. It had been said that the material was not available there for collection by the groynes, but in his opinion it was.

Dealing with the whole question of sea coast erosion, Urban Councils, such as Bray, County Councils, and other local authorities throughout the country were saddled with the burden of coast erosion, although quite incapable financially of dealing with it. The way the work on the sea wall at Bray had been carried out—the fact that the funds were provided, and the brains, the experience and the plant were available—was a very clear indication that such work should not be the responsibility of local authorities, but should be the responsibility of the State.

Only that day he had been down in Arklow where he examined the beach on which he had made a survey in September, 1941. Since then the high-water mark had gone inland by a distance of 150-ft. That represented a pretty considerable and rapid erosion, and it looked as if it was going to continue for a considerable time to come. None of the local authorities there, even if they had the money, would be capable of dealing with the problem without engineering assistance, and assistance in the way of plant which they would not be able to buy or even hire for such work. Mr. Delap, in his Paper, had shown them the manner in which difficulties that arose quite unexpectedly had been overcome with precision, care and great success.

Mr. C. J. Buckley, seconding the vote of thanks, said he would suggest, particularly to the younger Members of the Institution, that when the time came for them to submit Papers they could use Mr. Delap's Paper as far as possible as a model. Its style was admirable and there was not a superfluous word throughout the Paper. His references were very complete and the photographs were excellent. The only criticism he had to make was that the photographs would have been more useful if they had been somewhat bigger.

Quite a number of things came to one's mind when reading the Paper. The first was that it brought home the conditions under which engineers had been working in this country during what they liked to call the emergency. Materials were short; fuels, whether liquid, solid, or in the form of electricity, ran short at various times; plant was difficult to get and hard to maintain, and, as Mr. Delap pointed out, had they been able to get steel-sheet piling, the job might have been done in a different way.

Mr. Delap and his colleagues had tackled a very sticky job with very poor equipment, and at a time when there was a great shortage of material, particularly for reinforced work. They took what he considered was a very courageous step in making the caissons without any reinforcement. That was completely against the normal practice; these things usually had plenty of reinforcement.

He was sorry he did not know at the time that the undertaking was being carried out, because he would have liked very much to see it in progress. He was sure most engineers would. The Institution might consider the advisability of finding out where construction work was proceeding, and there might be some method by which the Members could be kept in touch with the construction work that was being done. They might visit different jobs and see for themselves how they were being carried out. The other man's job was always a little more interesting than one's own, and one could always learn from how other people did their work.

The possibilities of the system which had been used in Bray were very great. The eastern coast suffered a lot from erosion. He had no doubt, now that this system had been established so successfully, it could, possibly with adaptations, be used in other places.

Mr. E. J. F. Bourke said it was quite obvious that it would be impossible to prepare a specification for a job similar to the Bray Sea Wall undertaking. Nowadays engineers were expected to prepare detailed specifications. In this particular instance the work was very complicated. He would like Mr. Delap to give some information as to his estimate of the thrust of the tide in this area, and possibly he might say something about the movement of the sand.

It appeared from the paper that the sand movement between Bray Head and the harbour was purely local; it was moving south all the time, whereas Mr. Delap's estimate for the whole coast movement to the north seemed to be true. It would be interesting to know where the sand came from.

References had been made to the difficulties arising from the shortage of petrol, particularly in its application to the pumps. The pumps seemed to have been down on the beach, and there must have been a lot of moving of the pumps from the beach to higher ground when the tide came in. The old diaphragm pump still seemed to hold the field in that class of work.

Mr. T. H. Nolan, referring to Mr. Delap's observation that the reconstruction of the Bray Sea Wall was a comparatively simple task, said they had all listened to the Paper and seen the lantern slides and films, picturing what had happened to the sea wall, and he felt they would all agree that it was not a comparatively simple task, and that Mr. Delap had under-stressed the difficulties. The fact that the job cost what Mr. Delap liked to term a mere £15,000, did not indicate that there was not a considerable amount of highly technical work involved.

He wished to congratulate Mr. Delap on his photographs and also on the cinematograph film, which gave such a clear indication of the situation at Bray. It was very important to have a record of the actual conditions prior and subsequent to the work of reconstruction. Mr. Delap was to be congratulated on the able manner in which he set about making progress photographs. It was surprising the number of interesting jobs that were carried through to completion and the actual details of the work were lost for ever because no one thought of taking out a Kodak and securing photographs of the work at various stages, especially work that would be covered up as the Bray Sea Wall foundations had been covered up—they hoped, for ever.

The cinematograph film was doubly interesting, in so far as it bore out Mr. Delap's contention that the drift at Bray was from

*Paper (slightly abridged) discussed at a recent Meeting of the Institution of Civil Engineers of Ireland, and reproduced by permission.

Recent Protection Works carried out on the Sea Wall, Bray—continued

North to South, in the reverse direction from what it was generally along the East Coast. He expected most of them noticed that the direction of travel of the huge waves breaking over the promenade was from north to south, which bore out Mr. Delap's contention that the littoral drift was in that direction.

He was probably more fortunate than most people in that he had the pleasure of being shown over the works while they were in progress. He spent a most interesting evening at Bray with Mr. Delap, and he came away very much the richer in knowledge in regard to the construction of sea defence works. One point that really amazed him was when he looked at the forms that had been used for the pre-cast sections. Up to that he was under the impression that one could get four or five casts from a set of forms, which would then be discarded and a new set substituted. Mr. Delap showed him a set of forms at Bray from which he had taken no less than 80 casts, and those forms, for all practical purposes, were as good as the day they were made. He had no doubt if the promenade wall were long enough, Mr. Delap could have taken another 80 casts off the forms.

He would like some information from Mr. Delap with reference to the caissons, in which the walls appeared to be about 9-in. thick, and he thought that was very light for the wall of a caisson. He made a mental calculation that the available weight in the caisson for overcoming skin friction was less than 1 cwt. per sq. ft. He always understood that for trouble-free sinking of caissons the weight available for overcoming skin friction should be in the neighbourhood of 4 cwt. per sq. ft. He would like Mr. Delap to express some views on that point. He anticipated that the real reason was that they sank the caissons so quickly that the earth pressure had not time to develop against the walls; in other words, the full skin friction of the adjoining soil had not come into play before the caissons were sunk to their full depth.

If that were not so, he would like to ask Mr. Delap if he ever had occasion to use kentledge as a method of overcoming the difficulty of the caissons sticking. Sticking of caissons was probably one of the greatest snags likely to develop in the sinking of the caissons. The putting on and the taking off of the kentledge was a very laborious occupation, and it interfered with the progress of the work. Did Mr. Delap use kentledge at any stage of his work, or could the kerbs be used as kentledge? If a caisson stuck, would it have been possible to place a kerb in position and at the same time have men working inside? He had no doubt it would have been rather an awkward method, but he would like to know if it ever had been done.

He had been much impressed—and he was sure other engineers were, too—with the quality of the pre-cast work and also with the quality of the work in the kerb. The accuracy achieved in the kerbs was really amazing. He say the kerbs at Bray, and he could vouch for their beautiful finish. He could also vouch for the excellent line that Mr. Delap got in placing the caissons and the kerbs. That was a difficult thing to achieve. It was difficult to control caissons during sinking and get them exactly where one wanted them. Mr. Delap mentioned that there might be a few inches tolerance one way or the other. It was not uncommon to have to work to a few feet tolerance one way or the other in the sinking of caissons. Mr. Delap was to be congratualted on that particular aspect of the work, and the thoroughly satisfactory job he had made of the sea wall at Bray.

Mr. R. A. F. Dubsky said in Fig. 5 the pre-cast kerb projected beyond the face of the caissons. He thought it was generally accepted that one of the major causes of disintegration under the force of wave action was to be sought in air compression in various crevices or cavities. It appeared in this particular case that such crevice or cavity had been provided in the design. He wished to know if that was done intentionally or whether any attention had been given to the matter.

He thought it would normally appear to be more desirable to present towards the sea a more streamlined finish so as to take away any possible cause of disintegration due to a force acting on some projection or other.

A somewhat similar thing occurred on the existing wall, which was concave, with the curve towards the sea, and in a storm it was conceivable that air might be compressed in that space causing stresses on the wall which might eventually lead to failure.

Mr. T. M. McCann, referring to the littoral drift, said Mr. Delap and Mr. Murpny believed that the north to south drift at Bray was due to the high level groyne of the south harbour wall. He wondered if they had considered whether it was due to its projection from the shore or its height, or would it be due to its shape? Had they considered that the particular curve there might have some effect on the coast? In his younger days he observed the waves sweeping in by the harbour, particularly by the south pier. He had never noticed any similar action at the north pier. Perhaps the particular shape of the south pier was responsible for the conditions to which the Paper referred.

Mr. J. P. Candy said the Paper was one of the very few read at the Institution dealing with coast protection works. He did not think the problems of Coast Erosion and Sea Defence were really serious in this country, that is, not serious compared with similar problems in England. On the east and south coasts of England the local authorities were called upon to incur very considerable expenditure on sea walls and close groyning in order to protect their townships from the inroads of the sea.

In Ireland the problem was confined to certain points on the east coast, where the coast line consisted of friable material offering little resistance to erosive action. Bray was a vulnerable point, as also a short length of coast north and south of Bray. Much of the erosion on the east coast could be traced to artificial projections jutting out to sea disturbing the normal movement of littoral drift which on the east coast travelled from south to north following the direction of the flood tide. At Courtown, Arklow, Wicklow, and to some extent Greystones due to harbour projections arresting the travel of the drift, there was an accumulation of beach material on the south side or denudation on the north or both. The peculiar thing was that for some reason these conditions were reversed at Bray. The evidence indicated that along the front at Bray the travel of the beach was from north to south. Mr. Delap had suggested that this reversal was probably due to Bray Head functioning as a super groyne, and Mr. Candy was disposed to agree with this view. Littoral drift which was arrested on the south side of the Head in due course slipped past it some distance out in deeper water. The local currents then took charge and swung the drift round so that inshore it moved in the opposite direction from Bray Harbour on the north to Bray Head on the south. The construction of the harbour appears to have accentuated this southward travel along the Bray front.

In dealing with sea defence problems it was essential to differentiate between coast erosion and storm damage. Coast erosion was a slow gnawing action which went on summer and winter eating away only a small amount of coast line in depth in a year, but continuing to do so every year. Storm damage, as its name implied, was the direct result of a storm which might not occur for many years. When, however, a storm hit a coast line already subject to erosion, damage could be very considerable, because the erosion had provided conditions favourable for a storm to do its worst This, in effect, was what had occurred at Bray.

Coast erosion was a fascinating subject for study. To tackle any problem successfully it was necessary to have a correct long-term history of the case with the behaviour of winds, tides, currents, drift, etc., and as this was not usually obtainable, one had to depend on local information not always very reliable. The solution was generally a matter of trial and error. It did not follow that methods adopted successfully at one place would be equally successful at another place only a short distance away, because local and inshore conditions may not be the same. The conditions at Bray as described in the Paper were a case in point.

On the question of sea walls versus groynes, there was much room for controversy. Generally the best solution was a combination of the two. In the case of the Bray job, the essential thing was to secure the wall against under-cutting, as had been done. Mr. Candy thought the local authority should now put down one or two low experimental groynes in front of the recently-completed works, as suggested by Mr. Murphy, and study their effect in modulating the violent fluctuations in beach level which now took place. The design of the groynes should be such that they could be raised from time to time if the beach built up.

Recent Protection Works carried out on the Sea Wall, Bray—continued

REPLY.

Mr. H. A. Delap thanked the Members of the Institution for their kind reception of his Paper.

He agreed with Mr. Murphy that it would be very interesting to try some groynes at Bray, and it was quite possible that groynes carefully located and maintained would have a considerable effect in building up the beach. His own feeling was that the violent fluctuations in beach level would be the biggest difficulty. Where such fluctuations could not be controlled, groyning alone could not be relied upon to protect the wall since there was always the possibility that after they had worked successfully for 364 days, a severe N.E. gale would leave the wall completely exposed and as vulnerable as ever. Hence the decision not to rely upon groynes. But groynes might be valuable in building up the beach as an amenity, where it would not matter if for a few days each year the beach were to disappear.

He wished to emphasise that the theory put forward in the Paper as to the cause of the change in the beach was tentative. Mr. Burke, and other members, had raised the questions of where the beach material came from, and what happened to it at different times. It had to be admitted that they simply did not know. They could observe the results, the most obvious of which were that in general N.E. winds removed beach material, that S.E. winds replaced it, and that along the beach there was a tendency for material to collect on the north side and be removed from the south side of projections.

It was quite possible, as had been suggested, that Bray Head was the cause of the local reversal of drift. It also seemed to him possible that submerged banks further out were the primary cause; perhaps checking or dividing the tidal current, and producing an eddy inshore. But he was afraid that they had no definite information. The day-to day worries of a construction job did not encourage long-term observations of this kind. Their main interest in the tide had been: How soon was it going to come back?

He also had to admit that they had no useful information on the force of wave blows taken by the wall. Its factor of safety had at one point fallen below unity, but they had no reason to think that the waves which had caused that collapse approached the maximum of the 1941 storms.

He thought it quite possible, as suggested by Mr. Mc'Cann, that the shape of the south pier, in plan, had been of major importance in causing the changes on the beach—just as the orientation of a groyne might be as important as its height.

Mr. Nolan had questioned the description of the job as simple. He had only intended to convey that it was simple by modern standards. To those engaged upon it the work seemed anything but simple, but the finished work could be described by a single cross-section and a small-scale plan.

On the question of skin-friction, the sides of the caissons were battered and therefore tended to leave the beach material behind; they were also continuously lubricated by the flow of water into the caisson. One end, at least, was adjacent to the next caisson, and therefore free of skin friction, though always liable to be jammed by small stones. Great care had to be taken to avoid a nut-cracker effect, the adjacent ends of two caissons closing upon and being jammed by stones caught between them.

Kentledge was not used, mainly because of the fear of accident if the unreinforced walls of the caisson were to collapse. Some assistance to sinking was occasionally given by the use of a light piling hammer, hung from the crane.

The pumps used on the beach during low tide periods were handled by the electric crane. With a little practice in attaching slings to specially provided slinging lugs little time was lost.

The accuracy of the male and female ends of kerbs was obtained mainly by cutting the form-work for the ends out of solid pitch pine, 4-in. thick. This prevented distortion and could be renewed when worn

Mr. Dubsky questioned the projection of the kerbs over the side of the caissons. This projection was considered desirable for the final appearance of the work, in the same way that a concrete capping was used on a line of sheet piles, to cover any unavoidable unevenness in alignment. The projection would not, in his opinion, last very long as such—all relatively sharp edges would soon be abraided to a rounded shape. In any event it was considered, after a good deal of thought, that the anchorage of the kerbs, both vertically and horizontally, backed by concrete against the sea wall, was adequate to meet any danger.

Mr. Candy stressed that coast protection work was largely trial and error. This could not be said too often. The film showing waves breaking over the sea wall would make anybody realise that the sea was worthy of a great deal of respect. Nobody would lightly guarantee human works against such forces.

He wished to emphasise that the design and methods described were the product of team-work. Many ideas had been put forward and tried, some of them had been successful, others had been discarded. The value of two or more heads when trying new ideas was undoubtedly many times greater than their arithmetical sum.

The Dock and Harbour Authorities' Association

Annual General Meeting

The Annual Meeting of the Dock and Harbour Authorities' Association was held at the Dorchester Hotel, London, on 26th February last, under the presidency of **Sir Frederick J. West, G.B.E.,** Chairman of the Manchester Ship Canal Company.

In the course of his address, Sir Frederick said that during the war years and in these first years of peace the Association had been faced with grave problems vitally affecting the administration of docks and harbours. Amongst these the Transport Bill and the War Damage Act were outstanding.

Transport Bill

With regard to the Transport Bill, they had all been surprised by the drastic nature of this nationalisation measure which makes practically a clean sweep of all inland transport while giving little or no indication of how it is going to be organised and operated. Much has already been said at the Second Reading stage and a great deal will be said during the remaining stages as to the wisdom of this revolutionary experiment at the present juncture and of the haste with which it is being put through, but proposed to confine his remarks to the position of docks and harbours, the inclusion of which in this Bill was, in their view, quite unnecessary.

It must be said that the position was one of great uncertainty under the Bill as it now stood for while it was possible that docks and harbours might be left in their present forms of ownership, it was equally possible that schemes might be framed which would result either in the whole of the harbours coming under state ownership and centralised control or in some of them being so owned and controlled and the rest administered by autonomous bodies.

The Association had advanced the view that all trade harbours should be owned and operated by local autonomous bodies and none of them by the Transport Commission itself, or by any of the executive under delegated powers, and that within a limited period schemes should be prepared for vesting the railway and canal harbour undertakings in local autonomous bodies.

He would like to point out that local autonomy in the conduct of these undertakings was not inconsistent with any system of priorities or financial regulations that any national emergency or state planning might require. The vital necessity was to preserve effectively local interest and pride which alone are capable of infusing life and energy into the administration of these undertakings.

The Association did not dispute the desirability of carrying out a review of the constitution and facilities of the harbour undertakings of the country. On the contrary they had submitted to the Minister comprehensive proposals for this very purpose which were drawn up after long and careful deliberations and would have ensured an expert and independent examination of schemes or suggestions emanating from any interested quarter. They did not object to a review by the Transport Commission provided their function in relation to harbours is confined to review and that in

Dock and Harbour Authorities' Association—continued

considering any scheme of re-organisation or grouping, adequate consultations with expert bodies like the Association was assured and local opinion was given the fullest opportunity of being heard at a local inquiry conducted on similar lines to local government inquiries.

It was regrettable that amendments designed to give effect to the proposals he had outlined have been rejected by the Standing Committee on the Bill and that it would appear to be the intention to leave the Commission with unfettered discretion, subject to direction by the Minister, as to the exercise of the widest powers over trade harbours and port facilities.

War Damage

With regard to war damage, Sir Frederick said that no definite conclusions had been arrived at, but as the result of many discussions by the Executive Committee and a great deal of consideration by the Accountants' Committee, under the able leadership of Mr. Haworth of the Port of London Authority, progress has been made in the ascertainment of the total war damage sustained by the Dock and Harbour Group. It was the Government's intention to agree the basis of settlement with the Group before legislation is introduced.

Until the Bill which will deal with War Damage to Public Utility Undertakings is available, it is not possible to say what will be the position of a Dock and Harbour Authority which has not been designated as one of the Group so far as payment of contributions is concerned.

When the amount of Government compensation had been agreed it would then be possible to settle the method of apportioning the remaining deficiency between the individual members of the Group.

The Association now has a membership of 86—three new members having been added during the past year.

Members would recall that a special general meeting of the Association in the autumn revised the rules for the purpose of improving the system of election to the Executive Committee.

In conclusion, Sir Frederick said that this was the fourth consecutive year in which he had had the honour and privilege of occupying the Presidential chair, and in looking back, he doubted if any period in the history of the Association has ever called for greater co-operative effort by the Members.

"We have emerged from a disastrous war with many wounds but with justifiable satisfaction that we have made a valuable contribution to the nation's needs and I might add, also, that we emerge with a determinaion to face the problems ahead with confidence."

Adoption of Annual Report

Col. J. G. B. Beazley (Mersey Docks and Harbour Board), chairman of the executive committee, presented the committee's report, the adoption of which was moved by Sir Frederick West, seconded by Lord Saltoun (Fraserburgh) and passed.

Election of New President

Sir Frederick West proposed the formal election of Sir John Anderson (Port of London Authority) as president, saying he was a personality with a tremendous background of experience and knowledge. Sir Charles H. Newton (Railways) seconded the resolution which was unanimously adopted.

In his reply, the new president said he felt sensible of the compliment they had thought fit to pay him and the responsibility he had been asked to undertake at a critical juncture of the fortunes of the Dock and Harbour Authorities' Association, and, indeed, of the country. He would address himself to the utmost of his ability to any task that might fall to him as their president.

The following were elected vice-presidents:—Sir Alfred Read, J.P. (Ardrossan); Sir Arthur M. Sutherland, Bart., K.B.E., D.L., J.P (Tyne); Sir Thomas A. L. Brocklebank, Bart. (Liverpool); Alderman A. W. S. Burgess, J.P. (Bristol) Sir Frederick J. West, G.B.E. (Manchester); Sir John H. Irvin, K.B.E. (Aberdeen).

Lieut.-Col. Basil Nield, M.B.E., K.C., M.P. for Chester, was re-elected Parliamentary chairman.

Executive Committee

The executive committee was elected as follows:—Mr. J. K. McKendrick, North East Coast; Mr. A. H. J. Bown, East Coast; Sir Douglas Ritchie, M.C., London district; Alderman T. Lewis, M.P., J.P., South Coast; Mr. F. D. Arney, Bristol Channel; Mr. R. J. Hodges, Liverpool and N.W. district; Mr. Leslie Roberts, C.B.E., Manchester Ship Canal; Mr. H. Giles Walker, East Coast of Scotland; Mr. James A. Alexander, Northern Ireland; Mr. Percy McGrath, Eire; Mr. Tom A. Valentine, small ports representative; Sir James Milne, K.C.V.O., C.S.I., and Sir Charles H. Newton.

Annual Report of the Executive Committee for the Year Ended 31st December, 1946

The following excerpts have been taken from the Annual Report of the Executive Committee who, for the sixth successive year have acted under the Chairmanship of Colonel J. G. B. Beazley (Mersey Docks and Harbour Board).

Transport Bill

The Executive Committee considered this Bill at two meetings between its introducion at the end of November and its Second Reading on 16th, 17th and 18th December.

A Second Reading Statement was prepared and circulated to Members and a print of the Association's Report on Post-War Organisation of Docks and Harbours adopted by the Association at a Special General Meeting on the 14th February, 1945, accompanied this Statement.

Two Sub-Committees have been set up, namely a small Investigating and Drafting Sub-Committee, and a Policy Sub-Committee, consisting mainly of General Managers with a small Ports representative, with the object of preparing amendments to be put forward at Committee Stage, the Bill having been referred to Standing Committee B., which is now engaged in considering the Bill.

Arrangements have also been made to see the Minister before Committee Stage, with the object of elucidating some points in the Bill which are not clear.

In the Debate on Second Reading the Dock aspect of the Bill was referred to by a number of speakers, and the following extracts from speeches will be of interest:—

Lieut.-Colonel Basil Nield, the Association's Parliamentary Chairman, said: "In the first place would the House be good enough to consider the position of the dock and harbour authorities under the Bill? I will seek here to follow, and in some measure to approve, the observations of the hon. Member for South Bristol (Mr. Wilkins), who criticised the proposals of the right hon. Gentleman. I believe that representations have been made to the Minister by the Dock and Harbour Authorities' Association in this regard. This body includes in its membership no fewer than 82 dock and harbour authorities up and down the country, as well as docks and harbours which are at present owned by the four amalgamated railway companies. For the information of hon. Members I will ask the House to consider docks and harbours as divided into two groups. There are those which are now owned by the railway companies and which will be taken over by the State, and there are the independent ports. As a result of Clauses 70 and 71 the position will be that the Commission will take over and operate, as commercial undertakings, the ports at present owned by the railway companies. In regard to the independent ports, the Commission will have the duty imposed upon it by Clause 70 (2) to keep them under continuous review. They will have the widest possible powers to direct the policy of the independent ports, to group them, and even to take them over or transfer them, if they think fit so to do.

" My submission to the House is that it is fundamentally wrong that the Commission, in one capacity, should operate commercial undertakings, and in another capacity, should have the right to investigate the affairs of its competitors and direct their policy. The Commisson will be in competition with the independent ports. The Association which I have mentioned put forward a recommendation in February of last year, at the request of the then Minister of War Transport, to the effect that an Advisory Council should be set up to advise and to assist the Ministry, and that it should be composed of representatives of all the interests concerned. The suggestion I make is that, if this part of the Bill is passed, there should be an Advisory Council which would have the task imposed upon it of keeping the ports under continuous

Dock and Harbour Authorities' Association—continued

review. I hope that the right hon. Gentleman will be good enough to deal with this aspect of the matter and, if need be, to receive further and more detailed representations."

Mr. G. R. Strauss (Parliamentary Secretary, Ministry of Transport) said: "Some of my hon. Friends, and some hon. Members opposite, have raised points concerning our intentions in regard to docks and harbours. I was particularly surprised to find complaint by the Chamber of Shipping about our proposals, and to learn that they were opposing this Measure on account of the clauses relating to docks. In the past the shipping interests have complained over and over again about the inadequate facilities in our docks which, they have alleged, have handicapped them against the better dock facilities in other countries; and I felt sure that when we produced this Bill we would be certain to have the enthusiastic support of the whole shipping industry."

Mr. Maclay (Montrose Burghs): "I was rather surprised by the hon. Gentleman's statement because, turning to one of the documents of his own party, the name of which he was kind enough to give me, I found that his own party made this statement that, broadly speaking, dock and harbour facilities in this country had a high efficiency."

Mr. Strauss: "There may be a difference of opinion, but it is the shipping people who have always maintained that the facilities are inadequate. I would like to give a couple of quotations from their own document. In a publication issued by the Chamber of Shipping in 1929—I could quote many others, and subsequent ones if necessary, because I have a whole dossier with me—they support a statement that had previously been made by the shipping industry, which reads like this:

'The State should be prepared to assist in the development of the ports of the United Kingdom which are of national importance.'

Also in the 1930's, the Port Facilities Committee of the Chamber of Shipping said:

'Where there is excessive delay due either to lack of or inferior facilities or out-of-date methods, recommendations should be made for modernising or extending appliances or equipment or other facilities and, if necessary, the Government should be urged to assist the authorities concerned to provide these facilities either by grant or by loan.'

Surely, it is not suggested that the Government should hand out money to these authorities without any reorganisation, or any insurance that the money should be economically used in the right ports? Surely, it is not suggested that anything of that sort would be feasible without a measure of co-ordination under public authority?"

Mr. Maclay: "I appreciate the hon. Gentleman giving way to me. I would like to point out that the quotations he has given are very old. Even taking them as they stand, however, there is no conceivable reason why the State should not, in certain circumstanecs, lend or grant funds to harbour undertakings with suitable safeguards, if it is in the national interest. It is quite unnecessary to have State ownership to do that."

Mr. Strauss: "It is only by having authority over the docks, by grouping them into effective and economical groups and surveying all the docks in the country, by developing those which should be developed in the national interest, and not developing those where development is undesirable, that we can get a really effective national dock system. I suggest that the unification of our dock activities is essential to ensure the modernisation of appliances and equipment which the shipping industry requires. The regional schemes which we propose to set up will ensure that the necessary finances will be available, which has not always been the case in the past. The form which these schemes will take will be adjusted to local circumstances, and will make the best use of local initiative, on the clear understanding, of course, that the nation's port facilities must be regarded as one and not a series of competing units. I suggest to the hon. Member for Montrose Burghs (Mr. Maclay) that the Cooper Report on the Clyde Estuary gave a clear indication of what may be achieved."

Mr. Maclay: "But the hon. Gentleman will agree, I think, that the Cooper Report did not go very far with regard to grouping. It only went geographically as far as the Cumbraes. It did not suggest a great wide region, and, no doubt, there were good reasons for that."

Mr. Strauss: "I think it went as far as it could in the then existing conditions. The proposal might possibly have gone further if it was thought that something bigger and better was possible. One of my hon. Friends expressed the fear that when the Commission becomes the owner of all the railway docks it will compete, maybe unfairly, with the other docks to the disadvantage of those other docks. There is nothing in this contention. The responsibility for all the major docks and harbours will rest on the Commission, and as soon as they have drawn up these schemes and the schemes have been approved, the Commission will be responsible for their welfare. Therefore there can be no possible rivalry between these two sets of docks, because it will be the duty of the Commission to ensure equally the welfare of both."

Sir John Anderson (Chairman, Port of London Authority): "A word, now, about the ports, which for the most part are already publicly-owned. In the case of the important ports and harbours, they are in the hands of a public trust, or a local authority, or are owned by the railway companies. Quite obviously, if the railways are to be taken over, something must be done about the railway ports. I suggest that there is no sort of case for any change of ownership so far as the others are concerned, leaving out of account the very small ports to which special considerations may apply. The right hon. Gentleman, the Minister of Transport, put forward two arguments about ports. He talked about the need for finance, which I have already dealt with, and made a reference, which I confess I could not understand, to decasualisation. It is, of course, fully recognised that there ought to be a great measure of decasualisation throughout the ports, but I really do not see what bearing that has on the question of public ownership. There may be a point which I have missed, and perhaps it might be cleared up, but at the moment I simply do not understand it.

"I should like to stress the very special position of the ports. The Bill does not say that the ownership of any of the ports, apart from the railways, is necessarily to be changed; it says that ports and harbours are to be kept under continuous observation, schemes are to be put forward, and there is reference to co-ordination. Of course, there is a case for a better co-ordination of the ports, and that has been recognised for a long time. As the Minister knows very well, the Dock and Harbour Authorities' Association, a considerable time ago, submitted to his Ministry a proposal for better co-ordination, directed, in the main, to avoiding unnecessary and wasteful duplication of equipment and resources. That is the sort of co-ordination which is most needed if we are to make the most economic use of our national resources.

"What I want to stress here, in a few words, is this: that the ports are a link between sea and land transport. That is obvious. The proposal to fuse the port services into a reconstituted land transport system ignores altogether the vital position of the ports in relation to sea transport. There, I think, the Bill contains a very serious blunder. The flow of traffic through the ports, and the quick turn round of ships, is by far the largest controllable factor in economical sea transport. Ports have their own individual characteristics; they have in many cases their own trades, for which they have provided special facilities, and it would be disastrous if a change in their constitution were brought about which made it more difficult for the ports to respond quickly and effectively to the varying demands of our shipping industry. I would say to the Chancellor of the Exchequer, who is vitally concerned in our overseas trade, that there is a great danger, if this Bill comes into operation in the form which appears to be contemplated, of rendering a very great disservice to our national interest, for the reasons I have indicated. It need not necessarily be the consequence of the passing of this Bill, but it is a possibility which seems to be envisaged in the Bill, and as the right hon. Gentleman, the Minister of Transport, said that he was very ready to consider any arguments adressed to him on the details of the Bill I hope that this will be a matter which he and his colleagues will take very fully into consideration."

Finance (No. 2) Bill

The Act received the Royal Assent on 31st August.

Clause 32 provided for the reasonable cost of repairs and renewals deferred as a result of war conditions to be allowed as a charge against profits for Excess Profits Tax purposes in the appropriate

Dock and Harbour Authorities' Association—continued

accounting periods in which they accrued, subject to their being carried out before 31st December, 1947, or, if evidence is produced that this is impossible, before the 31st December, 1948.

It was pointed out to the Inland Revenue that a number of the Authorities could not possibly make good the cost of arrears of maintenance and dredging by the latter date, and Sir John Anderson, supported by the Association's Parliamentary Chairman, moved an amendment on Committee Stage designed to allow the Commission to approve a further period.

The Chancellor of the Exchequer on the Consideration Stage of the Bill moved an amendment to the effect that the Commissioners could approve an extension of the period, but not beyond 31st December, 1949.

War Damage

Considerable progress has been made in ascertaining the total amount of war damage sustained by the Dock and Harbour Group, although certain matters need to be resolved before the Government are in a position to introduce the Bill which will deal with the subject of war damage to Public Utility Undertakers. The group consists of 31 members of the Association and two non-members, and it is understood that the negotiations are more advanced than in the case of some other Public Utility Groups.

Several meeings of the Working Party, consisting of members of the Accountants' Sub-Committee and Government representatives, and also separate meetings of the Accountants' Sub-Committee were held during the year.

On the 23rd January, 1946, "Instructions for the Preparation of War Damage Claims," compiled by the Working Party, were issued to all members included in the Group, and returns have been furnished in accordance therewith. At this stage the treatment of the cost of raising and removing wrecks within Port limits and tenancies to or by undertakings remained to be clarified.

For purposes of the global settlement, losses in respect of "land," which had not already been made good, were to be assessed at March, 1939 prices, with the addition, except where it was not intended to replace, of a percentage to provide for the increased cost of ultimately carrying out the work. The percentage will be a vital point in the settlement and, when the Accountants' Sub-Committee have arrived at a conclusion, the matter will be referred to the Executive Committee before the question is resolved by the Working Party.

Several bases for the apportionment of the contributions to be borne by members of the Group were considered by the Working Party and examined in detail by the Sub-Committee. The matter was later discussed at a joint meeting of the Executive Committee and the Sub-Committee, when it was felt that the method of apportioning the contribution as between Undertakings could not be carried much further until the amount of the global contribution has been agreed. At this meeting a Sub-Committee of the Executive Committee was appointed for the purpose of settling with the Government the amount of the global contribution.

Agreement was later reached by the Working Party on the treatment of tenancies. Also, it was provisionally agreed to include in the claim the cost of marking of wrecks or obstructions, the buoying of channels, and any irrecoverable cost of the removal and dispersal of wrecks within Port limits and in or near the approaches. A "Supplementary Instruction for the Preparation of War Damage Claims," giving effect to these decisions, was compiled by the Working Party and issued on the 31st October, 1946.

The Working Party are considering the possibility of insuring against the risk of damage due to the explosion of mines, with a view to the inclusion of the amount of the premium in the war damage settlement.

The treatment of war damaged properties scheduled for acquisition under the Town and Country Planning Act, 1944, is being pursued.

Removal and Dispersal of Wrecks—Mines

Representatives of the Association, led by the Chairman of the Executive Committee, were received by the Minister of Transport on the 3rd April, when the position with regard to wrecks in or near the approaches to harbours and with regard to mines was fully discussed. A note of the meeting was circulated (Cir. No. 640, dated 16th April). The Minister's decisions following this meeting were shortly as follows (Cir. No. 647):—

(1) He is not prepared to introduce legislation to amend Section 530 of the Merchant Shipping Act, or to relieve Harbour Authorities of any common law liabilities which may arise from neglect or omission to exercise their powers under that Act or any Local Act.

(2) He advises Authorities to enter into contracts with the Admiralty with a view to the early removal or dispersal of war wrecks because the wrecks dispersal organisation can only be kept in existence for a limited period; and as to marking wrecks, arrangements should be entered into with the General Lighthouse Authority.

(3) As to the financial aspects, the Minister states that any irrecoverable expenditure incurred in marking and dispersing obstructions caused by the occurrence of war damage in waterways forming part of or giving access to ports should be treated as expenditure incurred in making good war damage to land.

(4) As to mines—direct damage arising from enemy or British mines will come within war damage. As to consequential damage, the Minister regretted that he could not justify an indemnity which would relieve Harbour Authorities of their common law responsibilities in respect of such damage.

While the Committee felt that the decision that losses in the case of wrecks—whether lying inside the harbour or in or near the approaches thereto—would have to be repaid as part of the war damage claim must be accepted, it was decided to press the Ministry for an indemnity with regard to damage from mines.

On this point letters were written to the Admiralty and Ministry of Transport, dated 3rd September, and the matter was further discussed at a meeting at the Ministry on 5th December, attended by representatives of the Admiralty and the Treasury.

The position as a result of this meeting is as follows:—

(1) In the case of claims against Dock and Harbour Authorities arising from direct damage from mines, the Accountants' Sub-Committee with the Ministry Accountants have been asked to explore the possibility of insuring for a period of three years against any risks Dock and Harbour Authorities may be liable to incur in respect of damage to their property due to the explosion of mines with a view to the inclusion in the war damage settlement of a commuted sum in respect of the premiums for such insurance.

(2) In the case of consequential damage arising from explosions of mines, Members of the Association should assure themelves that they have received from the Flag Officers in Charge the necessary certificates of the clearance of mines from areas within the jurisdiction of Dock and Harbour Authorities. If members have not received such certificates they should communicate with the Admiralty through the Area Naval Commanders, either directly or through the Association. It is thought that these certificates will be held to prove the absence of negligence on the part of a Dock and Harbour Authority in the event of third party claims being made in respect of damage arising from the explosion of a mine, and thus it is vitally important to take the action suggested.

Extract of letter from A. Barnes, P.C., M.P.:

"It was further agreed at the meeting that, in so far as any other obstructions are concerned, Dock and Harbour Authorities should ascertain whether the removal of such obstructions could not be dealt with in accordance with the terms of the Circulars P.T.C. 1117 and 1117A, which were issued to all the Authorities on the 30th May, 1945. Where obstructions do not come within the terms of these Circulars the matter should be pursued with the relevant Service or other Government Department concerned."

Discharge of Explosives

Members will remember the Indemnity dated 2nd December, 1942, given by the Government to Dock and Harbour Authorities (vide Cir. No. 558, dated 17th December, 1942) to cover loss or damage suffered by the explosion or ignition of explosives or petroleum spirit.

In view of the fact that the Government Explosives in Harbours Order, 1939, which relaxed restrictions relating to explosives "held for the service of a Government Department," will soon be revoked, it became necessary to reconsider the whole matter.

Dock and Harbour Authorities' Association

(continued)

Two meetings were held with representatives of a number of Government Departments concerned, and it was agreed that, subject to a satisfactory and comprehensive indemnity being obtained, there would be no objection to explosives of the types listed as permissible by a panel of experts being handled in U.K. Ports when the Explosives Order of 1939 no longer operates, provided that Regulations embodying suitable safety provisions are made under Section 97 of the Explosives Act, 1875.

The Association has nominated two representatives to assist in drafting the necessary Regulations.

Maritime Law

The Chamber of Shipping approached the Association in October with reference to a proposal to reconstitute the Comité Maritime International on a post-war basis, which would involve as a first step the reconstitution of the British Maritime Committee as the British Organ of this body. The Association was asked to nominate a representative, and Sir Douglas Ritchie, Vice-Chairman of the Port of London Authority, who had formerly acted for the Association on the old Committee with the late Sir William Thorne, agreed to represent the Association again.

Central Advisory Water Committee

At the request of the Ministry of Health the name of Mr. M. Kissane (Secretary, Manchester Ship Canal Company) was submitted for appointment as representing the Association on the above Committee. The Association's Parliamentary and General Matters Sub-Committee are considering a questionnaire submitted by the Committee.

One of the matters to be dealt with, namely, whether river pollution powers should be extended to tidal waters, is of considerable importance to Members of the Association.

Accounts

The expenditure charged to the year's Accounts amounts to £4,042 13s. 5d. and £3,889 3s. 6d. was subscribed by Members.

The deficit for the year amounted to £144 17s. 2d. which, deducted from the surplus for 1945 (£284 12s. 9d.) leaves surplus at 31st December, 1946, of £139 15s. 7d.

PUBLIC NOTICE.

THE ADMIRALTY have for disposal 700 Lifeboats (ex Ministry of Transport Lifeboat Pool) lying in all parts of the country, chiefly Liverpool, Glasgow, Thames (Molesey), Cardiff, Swansea, Hull, South Shields and Grimsby. These boats, new and second-hand, range from 20-ft.—30-ft. in length. Majority are of wooden construction. Few fitted with engines.

New craft all believed to be up to M. o. T. standard.

The sale of new and second-hand craft in good condition is restricted for use as lifeboats only.

For further particulars, apply in writing to: DIRECTOR OF SMALL CRAFT DISPOSALS, Admiralty, Department D.4, Fairmile, Cobham, Surrey.

TYNE IMPROVEMENT COMMISSION.

THE TYNE IMPROVEMENT COMMISSIONERS invite applications from qualified persons for the POSITION, under their Chief Engineer, of RESIDENT ENGINEER FOR THEIR DOCK ESTATES AT NORTH SHIELDS AND SOUTH SHIELDS.

Applicants must be corporate members of the Institution of Civil Engineers, be not less than 30 years of age and not more than 45 years of age on the 1st January, 1947, and have had experience of Dock and Harbour construction and maintenance.

Salary—£800 per annum plus War Bonus (at present £65 per annum) rising by Annual Increments of £50 to a maximum of £900 per annum. The person appointed will be subject to the provisions of the Commissioners' Superannuation Scheme.

Applications on a prescribed form, copies of which can be obtained from the undersigned, will be received up to the 9th April, 1947, and should be sent under cover addressed to the Chairman and marked "Resident Engineer—Docks."

The person appointed will be required to reside in the district and devote himself exclusively to the service of the Commissioners. Canvassing will be a disqualification.

By Order, J. K. KENDRICK, Secretary, Tyne Improvement Commission, Newcastle upon Tyne, 1

Notes of the Month

New Chairman of Clyde Trust.

Mr. Barclay Hogarth, of the Glasgow shipping firm of Messrs. H. Hogarth & Sons, was recently elected chairman of the Clyde Navigation Trust in succession to the late Mr. James Leggat. Mr. Hogarth was elected a trustee in 1933 and deputy-chairman last year.

Free Port Recommended for Panama.

The creation of a foreign-trade zone in the Republic of Panama was recently advocated by Thomas E. Lyons, executive secretary of the Foreign Trade Zone Board. His proposal followed a six-month study made for Panama through arrangement with the United States Department. Mr. Lyons said an area where goods could be unloaded duty-free for transhipment would attract many United States firms. He suggested the zone be set up near Cristobal mole in Colon Harbour.

Portuguese Mission Visits Port of London.

The Portuguese Government Ports Mission, at present in this country with the object of buying tugs, electric cranes and machinery for the improvement of Portuguese ports, recently visited the Port of London. The Mission, headed by Senor Salvador de Sa Nogueira, were received by Sir Douglas Ritchie, M.C., Vice-chairman, and Mr. Theo. Williams, General Manager of the P.L.A., and inspected loading and discharging equipment, warehouses, transit sheds, cold stores and wine vaults.

Life-Saving Equipment for Canadian Tugs.

A Canadian Court of Inquiry into the loss of a small tug in exceptional circumstances has recommended that all tugs and other craft of that type should carry a life raft on the superstructure. The Board of Steamship Inspection, after due consideration, has decided that the recommendation of the Court should be met by carrying in ships of this class some type of floating apparatus such as a "buoyant apparatus" in such a manner that it will float off the ship in case of a sudden emergency.

Heavy Lifts at Colombo.

The Colombo Port Commission has issued a statement that the British Stores Disposals Board (Ceylon) has decided to withdraw the 60-ton pontoon derrick, "Jumbo," which has been in use at Colombo on account of the Ministry of Transport. The only other heavy lift cranes available at the port are the Guide Pier steam crane, maximum capacity 20 tons at 60-ft. radius or 15 tons at 70-ft., and the 30-ton steam crane at the south side of the graving dock, which is available to make lifts from vessels in the dock.

New Tyne Quay Wall Proposal.

The Tyne Improvement Commission have been in contact with Felling (Durham) Urban Council regarding the council's suggestion that the site of the shipyard at Bill Quay, formerly occupied by Wood, Skinner & Co., Ltd., should be cleared and levelled and a quay wall 250-ft. long erected. The commissioners have pointed out that part of the land concerned belongs to them and had been acquired originally for the purpose of widening the River Tyne at that point. They were, therefore, interested in any developments which might be contemplated at the site and have asked the council for further details of their proposals.

Bhavnagar Ports Development Plans.

Plans for the development of the old and new Bhavnagar Ports and to secure a sufficient depth of water to enable six or seven steamers simultaneously to lie at anchor between the ports, were recently examined in Bhavnagar under the guidance of a British expert. This step was taken as the result of the recommendations of the Ports (Technical) Committee constituted by the Central Government of India. The committee met the Kathiawar Ports Commissioners in March last to explore the possibilities of developing Kathiawar's coastal traffic by affording safe refuge and anchorage to ships wherever such schemes are feasible along the coast.